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ABSTRACT

This manual contains materials for seven workshops on developing thinking skills in young children for teachers and teacher assistants in kindergarten through third grade. Contents of workshop (W) material focus, respectively, on (W1) convergent and divergent thinking; (W2) Bloom's levels of thinking; (W3) decision making, concept development, and problem solving; (W4) general questioning and evaluation strategies; (W5) using thinking skills in language arts; (W6) using thinking skills in mathematics; and (W7) using thinking skills in science and social studies. Workshops 1 through 4 could be used independently or presented in any order with slight modifications in introductory sections. Workshops 5 through 7 must be presented after workshops 1 through 4, because their content depends on ideas developed in the first four workshops. Workshops 5 through 7 could be presented in any order. Written materials for each workshop include an outline of steps to follow when presenting the workshops, lists of materials and steps to follow in getting ready for the workshops, an overview of what participants are expected to do, and a guide for the presenter on what to say and do. The guide includes a narrative, as well as transparency and handout masters. (RH)

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DEVELOPING THINKING SKILLS IN YOUNG CHILDREN

TEACHER/ASSISTANT TEACHER STAFF DEVELOPMENT MATERIALS

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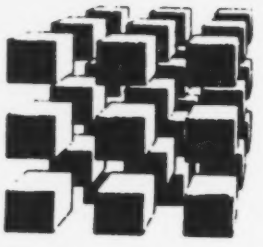

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DEVELOPING THINKING SKILLS IN YOUNG CHILDREN

TEACHER/ASSISTANT TEACHER STAFF
DEVELOPMENT MATERIALS

Bureau of School Improvement

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INTRODUCTION

This staff development manual contains materials for seven workshop sessions for teachers and teacher assistants in kindergarten through third grade. The workshop titles follow:

1. Convergent and Divergent Thinking
2. Bloom's Levels of Thinking
3. Decision Making, Concept Development, and Problem Solving
4. General Questioning and Evaluation Strategies
5. Using Thinking Skills in Language Arts
6. Using Thinking Skills in Mathematics
7. Using Thinking Skills in Science and Social Studies

Workshops 1 through 4 could be used independently or presented in any order with slight modifications in the introductory sections. Workshops 5 through 7 must be presented after workshops 1 through 4 because their content depends on ideas developed in the first four workshops. However, workshops 5 through 7 could be presented in any order.

To help persons presenting staff development sessions, the written materials for each workshop include several sections:

Workshop Leader Behaviors--an outline of steps to follow when presenting the workshops.

Workshop Preparation--lists of materials and steps in getting ready for the workshops.

Participant Responsibilities--an overview of what participants are expected to do.

Workshop Content and Activities--a "script", keyed to numbers in the outline of leader behaviors. The script is intended as a guide of things to say and do. The script can be modified and personalized by the workshop leader. Material within parentheses describes things the workshop leader will do. Material without parentheses is a guide of what to say. Each script contains several features.

A narrative as described above.

Transparency masters keyed to the script. The transparencies are intended to help the leader by providing a content outline. Using them will also help participants to follow the main ideas that are presented.

Handout masters are to be duplicated for participants' use. Some handouts are for use and discussion during the workshop. Others provide suggested assignments of classroom applications. Handouts are keyed to the script to help workshop leaders.

Follow-up assignments for participants must be handled according to local regulations and needs. It is strongly suggested, however, that "Think Tank" assignments (where teachers write ideas for future use) and classroom applications be utilized. After the first workshop ideas have been included for participant sharing of classroom applications. Short written records of classroom applications may also be required. It is suggested that the following assignments be required as minimal follow-up assignments for each workshop.

Workshop 1 - assignment 1 and two others of participants' choice.

Workshop 2 - assignment 1 and 9, and two others of participants' choice.

Workshop 3 - at least one assignment from each grouping: 1-5, 6-8, 9-11.

Workshop 4 - assignment 1 or 2, 5 or 6, and one from 2, 3, 7, 8, 9.

Workshop 5 - assignments 1 and 2.

Workshop 6 - assignments 1 and 2.

Workshop 7 - assignments 1 and 2.

WORKSHOP I

CONVERGENT AND DIVERGENT THINKING

This workshop session deals with convergent and divergent thinking. Research shows that teachers are usually quite competent in working with convergent thinking. Divergent thinking is used less often in classrooms. Divergent thinking is easy, but requires teacher awareness and consistency to implement in the classroom. In the workshop, participants will become familiar with divergent thinking and four aspects of this kind of thinking. They will participate in divergent thinking exercises and develop divergent thinking questions and activities for classroom use.

Workshop Leader Behaviors

The Workshop leader will conduct the following activities:

1. Introduce the workshop topic and overview all the thinking workshop topics.

2. Ask divergent thinking questions of participants and discuss the nature of divergent and convergent thinking.

3. Lead a role play situation contrasting divergent and convergent thinking.

4. Give a quiz on divergent and convergent thinking.

5. Describe Torrance's writing on four aspects of creative or divergent thinking and lead an exercise in which participants utilize Torrance's aspects.

6. Share tips for developing children's abilities in each of Torrance's aspects of divergent thinking.

7. Overview selected research findings on the importance of divergent thinking.

8. Give examples of divergent thinking in the primary grades classroom, lead participants as they generate ideas for subsequent use with children. Help participants evaluate their ideas and share them with one another.

9. Suggest several classroom applications for participants to carry out before the next workshop.

Workshop Preparation

Prepare the following materials before the workshop:

Transparencies 1a, b, c, and 1g through 1t
Handouts 1d, e, f, and 1u
Notecards

Gather props for the role play situation: a table, blindfold, and small rubber ball.

Obtain an overhead projector and 10-12 blank notecards for each participant. Carefully read the workshop overview and contents. Add examples related to curricular topics of current concern in your school district if you wish.

Participant Responsibilities

Inservice workshop participants will

1. Demonstrate understanding of material on convergent and divergent thinking by

   a. taking a quiz,

   b. responding to divergent thinking questions in oral and written forms,

   c. analyzing their own responses to a divergent thinking questions, and

   d. writing divergent thinking activities for their own classrooms.

2. Carry out divergent thinking activities in classrooms and prepare to present results at the next thinking workshop.

Workshop Content and Activities

1. Introduction

We are living in a period of rapid change. Ideas that are valid and pertinent today are likely to be obsolete tomorrow. Because facts and technology change so rapidly, we can no longer depend on pulling adequate solutions to problems from a pool of information. Even the types of problems we encounter have become more complicated; thus, we must learn <u>how</u> to think rather than <u>what</u> to think.

The increasing number of problems in the world today indicates the need for the fostering of thinking abilities to help us solve our problems. Effective thinking helps us cope with those problems we encounter every day.

Teachers can begin fostering children's thinking ability quite early. This series of workshops is designed to help you build children's thinking skills.

In these workshops we will explore the following interrelated topics (use transparency 1a):

1. Convergent and divergent thinking.
2. Levels of thinking according to Bloom.
3. Problem solving.
4. Concept development.
5. Decision making.
6. Classroom atmosphere to encourage children's thinking.
7. Questioning strategies--general guides.
8. Improving thinking skills in various curricular areas: language arts, math, science and social studies.
9. Evaluating children's thinking skills.

The workshops have three main goals: (transparency 1b)

1. To enhance your understanding of the various topics.
2. To help you plan appropriate thinking strategies to promote thinking in your classroom.
3. To facilitate your carrying thinking activities into your classroom.

2. Defining Divergent and Convergent Thinking

Today we are going to focus on divergent and convergent thinking. To illustrate one of these types of questions, take a few minutes to work through some examples with me. (Ask at least two of the following three questions. Notice that each question has several parts. Pause a few seconds after each part to let participants think through their answers.)

1. If you could be any place you wanted right now, where would you be? Imagine yourself there. What are you doing? Who is with you? Describe the surroundings. Now choose another place to be. Decide what you'll wear. Plan what you'll do for the day.

2. What gripes do you have about the latest fashions? Pretend you are a successful fashion designer. What would you change about current fashions? Create a new garment or accessory. Be daring or conservative, exotic or practical, but make your creation fit your personality.

3. Think about your place of work. If you were the boss, how would you change things? Remember you must be a responsible boss, making practical and workable decisions. Think of ways to initiate your ideas or changes.

(Take time to find out what some of their answers were.)

What was unique about the questions used? Notice that there was no one right answer. There were many, many appropriate answers. Questions of this type are called divergent thinking questions. Divergent thinking is the generation of many appropriate responses to a question or problem. It is the ability to think creatively, to depart from a set course or norm, and to move to a variety of new and unique responses. (Transparency 1c)

Let's compare divergent thinking with convergent thinking. Convergent thinking involves generating one acceptable solution or answer to a problem or question. In convergent thinking, people start with a problem and move toward one correct answer. Convergent thinking usually involves memorizing and using facts, interpreting data, and developing appropriate vocabulary usage. Teachers employ convergent thinking when they ask their students to match words with definitions, to memorize arithmetic facts, or to diagram sentences.

3. Role Playing Divergent and Convergent Thinking.

Divergent thinking is an important aspect of mental functioning. It is practical to use in classrooms. Let's compare two versions of the same lesson. One employs the traditional method of convergent thinking. The second is based on divergent thinking. Imagine yourself in a third-grade classroom in which the teacher is conducting a science lesson on the sense of touch. (Select seven participants to role play the convergent thinking lesson. (Handout 1d) They will use a table, a blindfold, and a small rubber ball. You will need 12 participants for the divergent

thinking lesson. (Handout 1e) They will use the same props. Hand each actor a script, and let the actor role play the mini lessons for the group.)

Let's compare the two lessons. There were several similarities. Both teachers elicited responses from the children. Both asked questions pertinent to the subject. Both used concrete objects and experiences to involve the children in their lessons. The main difference between the two lessons was the type of questions used. In the convergent thinking lesson, the teacher gave little room for choice; he seemed to expect one specific answer. When Ora Mae digressed, mentioning that she could squeeze the ball, the teacher brought her right back to the topic he had in mind. In the divergent thinking lesson, the teacher asked questions that had many possible answers. Thus, the children thought of many different ways to touch objects rather than just the conventional way of touching with their hands. The children were encouraged to examine and describe many characteristics of the objects they felt rather than only those suggested by the teacher. The first lesson was close-ended; the second lesson was open-ended.

(Now see if participants want to discuss more similarities and differences in the role play situation. Ask for any questions on the workshop's content to this point.)

4. <u>Testing Participants' Understanding of Divergent and Convergent Thinking</u>.

We are going to have a quiz of what we have learned so far. The questions in the handout are ones that teachers might ask during a unit on the family. (Handout 1f and give the participants time to work on it.) When the participants have finished marking the quiz, let them discuss their answers and why they made the judgments they did for each answer. The following answer key will help you guide the discussion.

1. There's one good answer here for each child; therefore, the question is convergent.

2. This question is convergent; again, there is only one good answer per child.

3. This question is divergent. Each child will probably have several reasonable answers and should be encouraged to state several things. The plural "ways" may suggest to children that more than one answer is appropriate.

4-5. These are divergent thinking questions which could have several answers.

6-8. All of these are convergent with just one correct answer. Number 8, a yes-no question, is especially narrow. If you asked how the youngest person helps, this question could be divergent with several possible answers.

9. Since there are several possible answers in this question, it would be considered divergent.

10. Notice that this statement is a task rather than a question. Many good divergent thinking questions will be placed in a problem solving format rather than as a question to be answered. This particular statement is divergent in nature because many children will contribute answers and some children might have more than one answer for a favorite home chore.

5. The Nature of Divergent or Creative Thinking.

As teachers try divergent thinking in their classrooms, they should know more about its nature. In some of his work, J. Paul Torrance, an educator well known for his work on creativity, presented divergent thinking as an important aspect of creativity. Torrance (1971) described four interrelated aspects of creative or divergent thinking: fluency, flexibility, originality, and elaboration. Fluency (transparency 1g) is simply the number of different responses a person can make to a question or problem situation. Flexibility (overlay transparency 1h) is defined as the number of different categories into which answers can be placed. Originality (overlay transparency 1i) means the uniqueness of responses. Elaboration (overlay transparency 1j) is the amount of detail given in responses. As teachers use divergent thinking exercises, they might make students aware of these different aspects and the relation of each one to the process of divergent thinking.

Let's do an exercise to further examine these aspects. Take a piece of paper and when I say "go," you need to write as many things as you can that have legs. We will work for just two minutes and then quit. Ready--go. (Call time after two minutes. Now let participants compare answers for a short time. Next have participants count their answers. The number of answers one has is a measure of fluency--the more answers, the more fluent the person has been. Now have participants suggest some categories for answers--furniture, animals [they may subgroup this as mammals, birds, insects or other animal groups], etc. Participants should categorize their answers and then count categories as a measure of flexibility. The more categories a person has, the more flexible his or her thinking is. To get an impression of originality, have participants work in small groups and find

unusual or very infrequently occurring answers. These answers, according to Torrance, are original. See if any participant has given elaborated answers--ones with detail or descriptive words. The instructions for the activity, with strict time limitations, have not really encouraged elaboration. Take a minute or two now to let participants elaborate verbally on answers. If someone has named a spider as something with legs, encourage the person to tell specific aspects of that spider. For example, a spider with long, hairy, crooked legs is a more elaborated image than the word spider alone.

6. Tips for Developing Different Aspects of Creative Thinking in Children.

Research shows that children's creative thinking ability can be enhanced. Here are some tips on ways to improve children's creative thinking.

Fluency (transparency 1k)

- Start with a topic that is interesting or familiar to build the children's confidence. Children have trouble dealing creatively with unfamiliar or abstract topics.

- Ask for many answers. Make it clear that your purpose is to get lots of answers. Use plurals. Use phrases such as "Can you tell me more? What else? Can we add to that?"

- Give children time to think. Come back to children who have already contributed; they might suggest additional answers after a period of time.

- After a pause, encourage your children with comments such as "What are some more answers?"

Flexibility (transparency 11)

- After children have suggested several answers, point out the categories to which answers belong. This process will help children learn to focus on categories.

- After children have given many answers in one category, suggest different categories. For example, after children have named different furniture items with legs, introduce a new category such as animals.

- After you have suggested new categories, invite children to introduce categories of their own. To encourage them, you might say "Can you think of another group of things that has legs?"

Originality (transparency 1m)

- When children introduce an unusual answer, praise their originality.

- Explain often what aspects of an answer are unusual. On the legs problem, if a child mentioned legs of a trip, you might say "How original! We have had many items of furniture mentioned, and lots of animals, but no one has thought of a trip!"

- Guide the children's thinking with phrases such as "Think of something nobody else could." or "Tell me something really unusual."

Elaboration (transparency 1n)

- When children suggest answers, encourage them to tell about their answers in more detail.

- Allow plenty of time if children are to produce elaborated responses.

- Ask leading questions such as "Tell me more about it," "What would it look like?", "What kind of _____?"

7. Importance of Divergent Thinking: Research Findings.

Why stress divergent thinking? (transparency 1o) The reasons are numerous. In our society we have wonderful machines to do much of our routine, repetitive work. People are free to behave productively and creatively (Torrance, 1977). Today's problems are complex; solving them requires generating and evaluating many solutions (Shaw and Cliatt, 1984). People must learn to do more than process facts; they must learn to think creatively (Raths, 1967). Creative students are adaptable, self-sufficient, and sensitive to their surroundings and to other people (Renick, 1983). When creative thinking is used frequently in classrooms, students have more positive attitudes about school (Forseth, 1980).

Divergent thinking is an important and beneficial skill; yet, it is used infrequently in most classrooms. (transparency 1p) Some adults do not believe that children can think divergently; yet, research results demonstrate that children as young as three and four years of age can respond to divergent thinking (Pepler and Ross, 1981; Turner and Durrett, 1975). Kindergarteners increased their verbal creative thinking skills dramatically after a training period (Cliatt, Sherwood, and Shaw, 1980). Special education students, including groups of mentally retarded, emotionally handicapped, and gifted people, have benefited from instruction in divergent thinking (Cherry, 1972; Lowery, 1980; Nickse, 1971; Sharpe, 1976). Numerous studies have shown that people of different ages, sexes, races, and socioeconomic groups have profited from training and experiences in divergent thinking (Johnson, 1974; Huntsberger, 1976; Mansfield and Busse, 1974).

Studies have also shown that classroom time spent on divergent thinking complements acquisition of basic facts and mastery of traditional subject matter. (transparency 1q) Divergent thinking cannot be considered a "frill" or a waste of time. For example, elementary children exposed to divergent thinking experiences not only increased their divergent thinking abilities, but also improved their concept acquisition and academic skills in social studies (Clague-Tweet, 1981). Students who participated in divergent thinking activities in middle grades science out scored conventionally-taught peers on measures of both science concept achievement and flexible thinking (Davis, 1976; Scott and Sigel, 1965). Other studies show similar results in various curricular areas (Callahan and Renzuilli, 1977; Huntsberger, 1976; Johnson, 1974; Mansfield and Busse, 1974; Raimo, 1978).

8. Developing Divergent Thinking Activities for Your Classroom.

Despite its importance, divergent thinking is not used as much as it could be in typical classrooms. Convergent thinking seems to "come naturally" to most adults; divergent thinking is less familiar as a classroom technique. Educators need training like you are receiving before they fully understand the potential of divergent thinking. They need motivation to actually carry out divergent thinking activities in classrooms.

If teachers and assistants are conscious of it, divergent thinking can fit in with virtually any topic they are teaching. For example:

When teaching the oral language skill (transparency 1r) have children express their ideas about pictures, objects, or experiences. Ask things such as:

What does it remind you of?
What might be happening in this picture?
What might happen next?
What feelings do you have about this?

When classifying objects (transparency 1s) you might ask:

Can you think of other ways to group these blocks? Show me.
How are these leaves alike?
How are the leaves different?

When working with magnets (transparency 1t), try these divergent tasks:

What other things might magnets attract?
Find at least four things in the room magnets won't attract.
Magnets will attract through paper (demonstrate this). What other things might a magnet attract through? Let's try some out.

Now let's take some topics that you'll be working with next week. Work in groups of three or four. Talk about a topic you'll be teaching and the objectives. Plan several divergent tasks for your topics. (Allow sufficient time for participants to do this activity. Then direct two groups to work together and check each others' tasks to be sure they are divergent in nature.)

Even after teachers have developed good divergent thinking tasks, it's not easy for them to remember to apply the tasks in their everyday teaching. Recording good ideas and filing them in a usable system is helpful to most teachers and assistants.

In our series of workshops, we will be developing a "Think Tank" box for each classroom. In the box participants can keep all sorts of good questions and tasks to stimulate children's thinking. (Pass out several notecards to each participant. Let them record good divergent thinking ideas their groups have generated. Let groups share a few of their best divergent thinking ideas with each other. Encourage participants to note any applicable ideas for their own "Think Tank" boxes.)

9. More Classroom Applications.

The more you use divergent thinking with your students, the more their ability to think divergently will grow. Also, your ability to ask divergent thinking questions will grow as

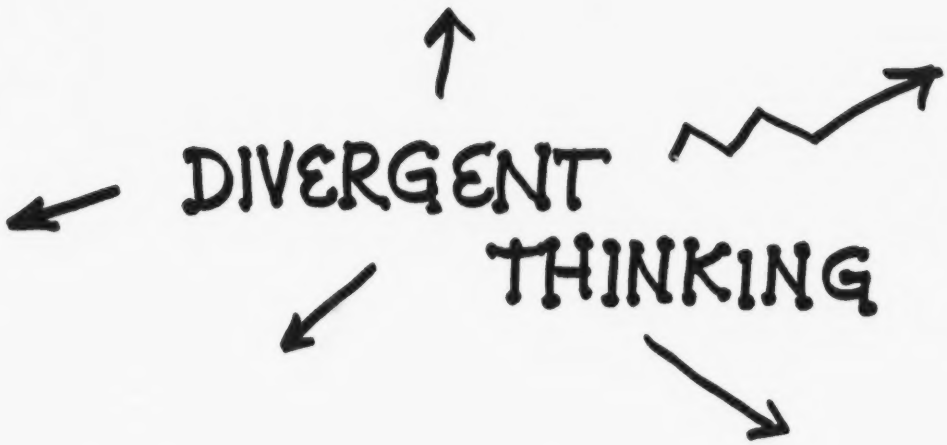
you consciously apply the use of it in your classroom. Therefore, we are assigning several classroom applications. (handout 1u) You should complete numbers 1 and 2 and choose at least three of the remaining options. We will share results at the beginning of the next workshop. (See if participants need further clarification on their general or specific assignments. Remember that participants must actually apply material learned in the workshop to make progress, so you must assign classroom work. The assignments suggested do not require much extra work of teachers and their assistants; rather, they give them the opportunity to practice what they have learned in the settings in which they are already working.)

Workshop Topics

- Convergent & Divergent Thinking
- Bloom's Thinking Levels
- Problem Solving
- Decision Making
- Concept Development
- Classroom Atomosphere to Promote thinking
- Questioning Strategies in General
- Evaluating Children's Thinking
- Improving Thinking Skills in Curricular Areas

- WORKSHOP

- Enhancing teacher understanding
- Planning thinking activities for young children
- Carrying out thinking activities in classrooms

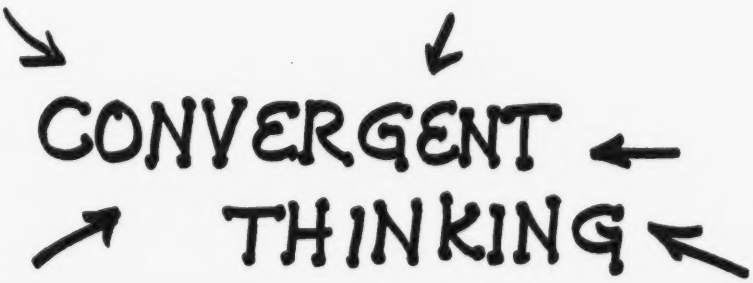


Many appropriate responses

Thinking creatively

Departing from norm

Moving to new & unique responses



One acceptable response

Moving toward a single good answer

CONVERGENT LESSON

Teacher: What sense are you using when you feel something?

Ken: Touch.

Teacher: What do you feel with? Lisa?

Lisa: Your hands.

Teacher: Your hands. Right. If you couldn't see, your hands could still tell you a lot about the world around you. Go ahead. Close your eyes. Find the desk in front of you. Does it feel rough or smooth?

Class: Smooth.

Teacher: Is it warm or cool?

Class: Cool.

Teacher: Now, feel around the edge of your desk. What shape is it, Judy?

Judy: Square.

Teacher: Keep feeling, Judy. Are all four sides the same length?

Judy: Well, no.

Teacher: When two sides are longer than the other two, what shape is it?

Carmen: A rectangle!

Teacher: Yes. Everybody feel the rectangle . . . two long sides and two shorter ones. I have some things up here, and I want you to feel them. Billy, you will be first. Here, let me put this blindfold on you, okay? Choose an object. (Billy picks a piece of sandpaper.) Is it rough or smooth?

Billy: Rough.

Teacher: Are both sides the same?

Billy: Well, one side is rough and one's smooth.

Teacher: What shape is it?

Billy: A circle.

Teacher: Is it thin or thick?

Billy: Uh . . . pretty thin.

Teacher: Good, Billy! Who wants to be next? OK, Ora Mae, it's your turn. Here's the blindfold.

(Ora Mae picks a small rubber ball.)

Teacher: What's the shape of your object?

Ora Mae: Well, it's round. It's a ball.

Teacher: Is it rough or smooth?

Ora Mae: It's smooth. Look, you can squeeze it.

Teacher: Yes, but tell me what size it is. Is it big or little?

Ora Mae: It's pretty small.

Teacher: Fine. Khee, do you want to be next?

(Khee comes up, gets blindfolded, and picks a brick.)

Teacher: Khee, is your object heavy or light?

Khee: Heavy!

Teacher: Is it rough or smooth?

Khee: Well, it's rough.

(The children continue to take turns feeling objects and responding to the teacher's questions.)

DIVERGENT LESSON

Teacher: What are some ways you use your body to find out about things?

Jon: Well, you look at things.

Suzy: You can talk and hear things.

Marshall: I just heard a siren outside. I'll bet there's a fire. Maybe it's coming to this school!

(Laughter)

Teacher: Yes, we can tell a lot by seeing and hearing things. Can you think of other ways to find out about things?

Kevin: You can taste things to see if they're good.

Joanna: Well, if you were blind, you'd feel things.

Teacher: There are lots of ways to find out about things. Let's talk about feeling and touch. There are many ways to feel things. Can you think of some? Marshall?

Marshall: We feel with our hands.

Teacher: What if you didn't have hands? Could you still feel things? Ruby?

Ruby: When I take off my shoes, I can feel with my feet.

Teacher: Good. Can you think of another way?

Ruby: Well, you could even feel it with your elbow!

Gladys: And your tongue!

(Several more body parts are suggested.)

Teacher: OK. We can feel with many different body parts. Close your eyes. Right at our desks, what could we feel? Emily?

Emily: I can feel the pencil tray.

Vickie: Well, somebody put gum under my desk. I can feel it.

Teacher: Scott?

Scott: I don't know.

Teacher: Well, try the sides.

Scott: I don't know. Well, it's flat.

Teacher: Good, Scott. Now, I have some things up here, and I want you to feel them. Billy, you be first. Here, let me put this blindfold on you, OK? Choose an object. (Billy picks a piece of sandpaper.) How does it feel to you?

Billy: Well, it's rough.

Teacher: Can you think of some other things to tell me about it?

Billy: It's got little bumps all over it.

Teacher: All over it?

Billy: Well, not here. The bottom is smooth.

Teacher: What does it remind you of?

Billy: It's sandpaper. It reminds me of the sandpaper Dad and I used when we refinished the table.

Teacher: Good, Billy! Who wants to be next? OK, Ora Mae, it's your turn.

(The children continue to take turns feeling objects and responding to the teacher's questions.)

CONVERGENT OR DIVERGENT THINKING QUESTIONS?

Suppose you are teaching a unit on the family. One day's objectives are for the children to name the members of their families, to describe home chores of each family member, and to tell how family members are dependent upon each other. Imagine that the teacher and the assistant have split the class into two discussion groups. By dividing the class, each child will have more chances to talk and to contribute than they would working with the entire class.

Examine each of the questions below and mark whether it seems to be a convergent or divergent thinking question or task.

_____ 1. How many people are in your family?

_____ 2. What are your parents' names?

_____ 3. What are some ways that you help at home?

_____ 4. What are other things you might do to be helpful that you don't do now?

_____ 5. Sometimes we help by doing something. At other times we are helpful by making people feel good. How can we make somebody in our family feel good?

_____ 6. Who is the youngest person in your family?

_____ 7. How old is that person?

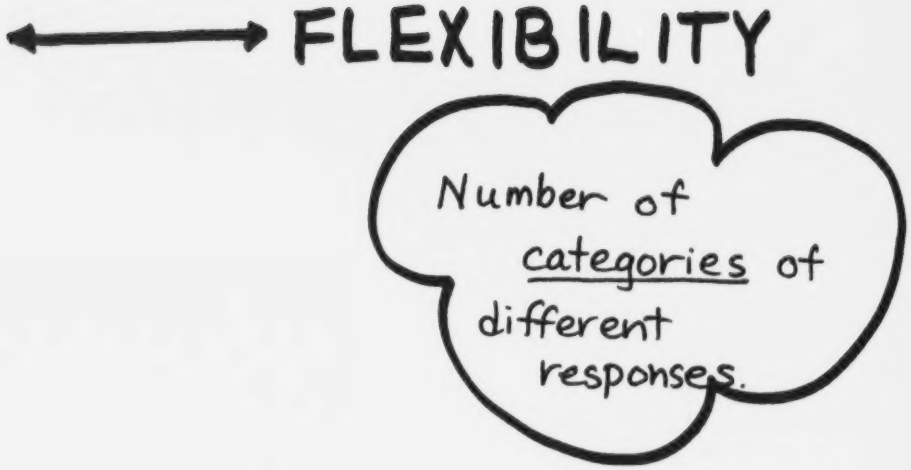
_____ 8. Does the youngest person help?

_____ 9. What are some things your parents do for you that you can't do for yourself?

_____10. Let's make an experience chart of our favorite home chores.

Torrance's Four Interrelated Aspects of CREATIVE THINKING

FLUENCY



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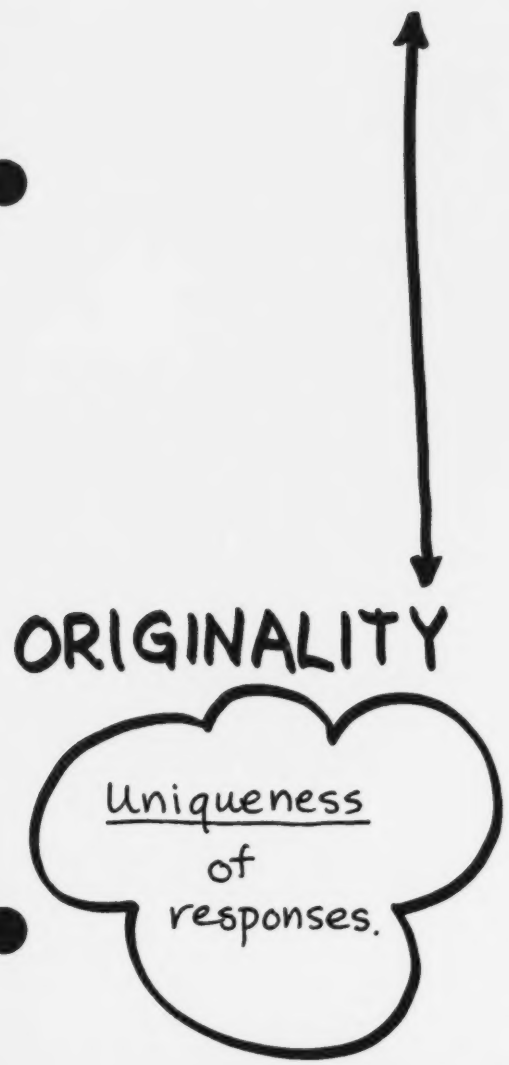

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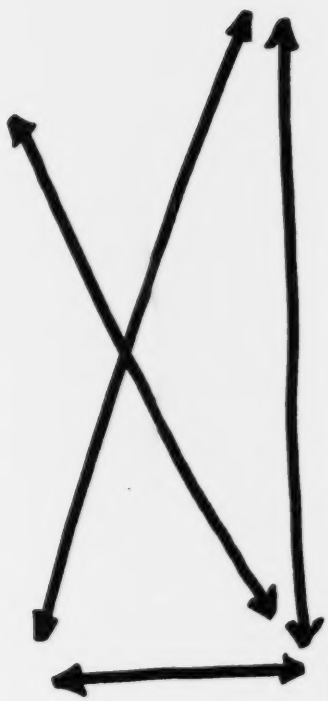


ELABORATION

Amount of detail in responses.

INCREASING FLUENCY

(Number of responses)

- Start with familiar topics.
- Ask for many answers.
- Give time to think.
- Ask for more answers.

- IMPROVING FLEXIBILITY
  (Number of categories of answers)

  - Point out categories used.
  - Suggest other categories.
  - Invite children to suggest categories and answers in the categories.

- IMPROVING

ORIGINALITY

(unique answers)

- Praise unusual answers.
- Explain why answers are unusual
- Guide children -- "think of something no one else will think of ... something really different."

lm

INCREASING ELABORATION

(Amount of detail in responses)

- Encourage telling or drawing detail.
- Allow plenty of time.
- Ask leading questions --
  - "Tell me more about it."
  - "What would it look like?"
  - "What kind of ...?"

In

WHY STRESS ?

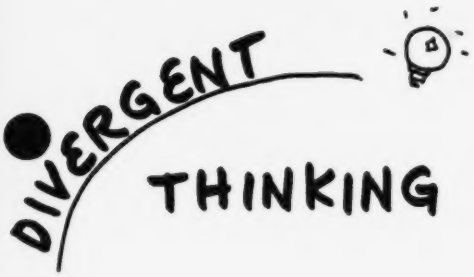
- Machines do routine work; people are free to think creatively -- Torrance

- Complex problems require creative solutions -- Cliatt, Sherwood, Shaw

- People must deal with more than facts; they must think creatively. Raths

- Creative people are adaptable, sensitive, independent -- Renick

- Creative thought promotes positive attitudes toward school -- Forseth



Works in Classrooms!

- Three and four year olds use it successfully.
- Kindergarteners increase abilities after training.
- Many groups benefit from instruction in divergent thinking.

  Mentally retarded
  Emotionally disturbed
  Gifted
  Different ages
  Both sexes
  All races
  All socioecomic groups

14

DIVERGENT THINKING ... not a frill!

Complements acquisition of basic facts and mastery of traditional subject matter.

- Social Studies
- Science
- Math
- Language Arts

DIVERGENT THINKING in ORAL LANGUAGE

Use a picture.

What does it remind you of?
What might be happening?
What might happen next?
How does it make you feel?

DIVERGENT THINKING in SCIENCE

Classify some objects.

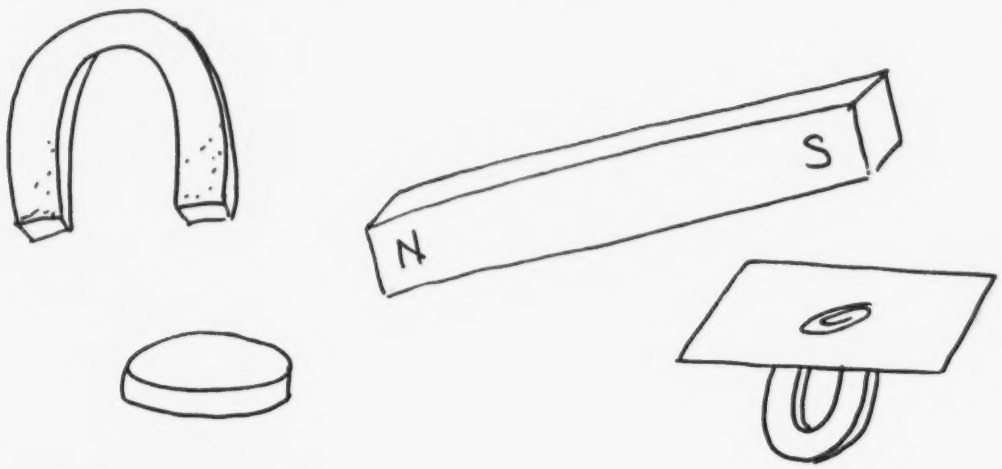
How can you group these?

How are they alike?

How are they different?

DIVERGENT THINKING in SCIENCE

Working with magnets



What else might the magnet attract?

Find at least 4 things that it won't attract.

the magnet attracts through paper. What else will it attract through?

CLASSROOM APPLICATIONS--DIVERGENT THINKING

The only way you can practice encouraging divergent thinking is to do it in the classroom. As you present divergent thinking situations, your students' abilities to use divergent thinking will also grow. Before the next thinking skills workshop, your leader will ask you to do several of the following assignments:

1. Add at least 10 divergent thinking tasks to your "Think Tank" box for topics you will teach in the next week.

2. Obtain and decorate a "Think Tank" box to hold the cards you have started in this workshop. A commercially-made file box is fine or you can improvise a box from a cereal or cracker box. Make some dividers for your box. Label the first divider "Divergent Thinking."

3. Ask a group of children a divergent thinking question and record their answers on a language experience chart. Read back over the answers and help children categorize their answers and analyze their flexibility. You might use the "legs" topic we used today.

4. Give the children a nonverbal divergent thinking task such as drawing a picture of some unusual community helpers. Display the children's work using a caption such as "Lots and Lots of Community Helpers." Bring several very original examples to the next workshop.

5. Jot down 10 questions you asked the children in a class period. Analyze them to see if they are convergent or divergent. If you don't have at least 1 or 2 divergent thinking questions out of 10, make a more conscious effort to insert divergent thinking questions.

6. On "Think Tank" cards, note some of the children's responses and reactions to your divergent thinking questions. Note especially effective questions for use another time or with another group of children.

7. Tape record children's answers to divergent thinking questions. Use the tapes to analyze children's answers or for the children to listen to. Often, after hearing their own answers, children will suggest even more answers.

8. Design and implement an original divergent thinking activity with children. Bring some evidence of results to the next workshop.

9. Emphasize elaborated divergent thinking answers. Ask a general question with many answers such as, "What do you like to do on Saturdays?" Have children respond, then encourage each child to give details. Praise detailed responses. (This activity is best done in groups of five to seven, so that each child gets a chance to talk.) Use remarks such as "Tell me some more about it" to get children to give extended, detailed answers. Jot down some of your questions and the children's responses so that you can summarize them at the next workshop.

10. Design your own divergent thinking activities and bring results of them to the next workshop.

WORKSHOP 2

BLOOM'S LEVELS OF THINKING

This workshop involves exploration of Benjamin Bloom's well-known model of thinking. Teachers and assistants are probably familiar with Bloom's Taxonomy of Education Objectives for the cognitive domain. This workshop will allow them to further explore the model and plan to apply the model in their classrooms. Workshop activities include discussion, a quiz on Bloom's levels, use of Bloom's levels, and preparation of materials for the classroom.

Workshop Leader Behaviors

The workshop leader will conduct the following activities:

1. Lead participants in sharing results from the previous workshop.

2. Discuss each of Bloom's levels and share examples of each.

3. Give a quiz in which participants identify examples of each of Bloom's levels.

4. Instruct participants to use Bloom's levels in a social context and evaluate their usage.

5. Facilitate group work in which participants generate thinking tasks for use in their classroom. Help participants evaluate and share their proposed thinking tasks.

6. Direct a work time in which participants start language experience charts or bulletin boards to be completed in their classrooms.

7. Assign further work to be carried out and documented in classrooms.

Workshop Preparation

Prepare the following materials before the workshop:

Transparencies 2a through 2n
Handouts 2o, 2p, and 2q

Gather materials for the worktime portion of the workshop. You will need:

at least 2 pieces of chart paper for each participant (Provide used computer print-out sheets as a substitute if necessary. The backs of these sheets make good experience charts because they are lined.)

6-8 sheets of construction paper for each participant

several patterns for bulletin board letters

10-12 notecards per participant for "Think Tank" ideas, scissors and felt tip markers

8-10 old magazines or catalogs or other sources of pictures

Obtain an overhead projector. Carefully read the workshop overview and script.

Participant Responsibilities

The inservice workshop participants will

1. Receive information on Bloom's levels as applicable in the primary grades and demonstrate their understanding by

   a. taking a quiz

   b. using each of the levels in a social context

   c. planning and initiating Bloom's levels of questions in bulletin board and experience chart activities.

   d. adding various levels of questions to their "Think "Tank" boxes.

2. Apply Bloom's levels of thinking tasks in classrooms and prepare to present results at the next workshop.

Workshop Content and Activities

1. Sharing of Results of Divergent Thinking Activities. (Have participants form groups of four or five. Give the following directions.) We will share results of our divergent thinking exercise in groups today. First take just five minutes and share one or two of your best ideas from your "Think Tank" boxes. Next choose one of your additional assignments--perhaps the one you found most challenging or the one on which you got the best

responses. Show and tell with your colleagues on this for just ten minutes. (During the sharing time, circulate and listen for good ideas and problems. Discuss just a few of the best ideas or most common problems with the entire group of participants. Sharing time should move quickly to prevent boredom.)

2. Bloom's Levels of Thinking. The Taxonomy of Educational Objectives, written in 1956 by Benjamin S. Bloom is well-known in educational literature. Bloom and his associates divided cognitive objectives into six categories: knowledge, comprehension, application, analysis, synthesis, and evaluation. (transparency 2a) They categorized student behaviors by their complexity assuming that higher level objectives build upon lower level objectives; thus, Bloom's levels form a hierarchy.

   You have probably already explored Bloom's levels in other inservice work. Since Bloom's ideas are so important in ensuring that children are encouraged to think on levels beyond memory and recall, we will work further on Bloom's ideas in a primary grades context. Let's review what each of Bloom's levels means and share some examples of things children might do on each level. Knowledge is the simplest level according to Bloom's Taxonomy (transparency 2b) but it is the basis for all other levels of thinking. Knowledge concerns recall of facts and definitions. This level of thinking could include recall of details, main ideas, sequences, comparison, cause and effect relationships, or character traits; but the information required of the student must be explicitly stated in the text or by the teacher. The student is not required to move beyond a simple recall of facts. Although knowledge is the simplest level of thinking, it is the foundation upon which all other levels of thinking are built. Therefore, teachers need to concentrate on helping children build a strong knowledge base. Without a strong knowledge base, we couldn't have the simplest communication. Without basic knowledge we would have nothing to communicate to the world and lack a basis for understanding others. Studies show that teachers seem to do much knowledge level questioning in the classroom.

   Our next level of thinking according to Bloom is comprehension. (transparency 2c) Comprehension builds upon knowledge. Comprehension concerns three types of mental functioning: translation, interpretation, and/or extrapolation.

   Translation (transparency 2d) requires the changing of information into a different form or style. For example, after a discussion on how caterpillars hatch from eggs, spin a chrysalis and later

change to butterflies, children might draw pictures of the egg, caterpillar, chrysalis, and butterfly stages and arrange them in the right order. Here the children have translated words into pictures. Translation could involve children explaining and clarifying a basic fact in their own words.

When we use interpretation thinking tasks (transparency 2e) with young children, we might ask them to look for similarities and differences. For example, to build children's visual discrimination skills, an important part of reading readiness, teachers might ask children to tell the ways a mop and a broom are alike and ways that they are different. Other interpretation tasks for young children include determining relationships and comparisons between things. When children are learning about money, they learn to compare the appearances of coins as well as the value of each coin. They quickly learn that a dime will buy more than a penny will. Interpretation could involve giving examples to make facts or ideas clearer. For instance, after learning about squares and rectangles, children might walk around the room and point out examples of each.

Another form of comprehension is extrapolation: (transparency 2f) the ability to infer the unknown from the known. For example, children might be asked to supply supporting details or to infer the main idea from facts given. Students may be asked to suggest character traits based on clues given or to predict outcomes based on certain information. For young children to be able to extrapolate, the known must be very concrete and something that they have experienced. Although few kindergarten children will be able to extrapolate, more third graders will be able to use this thinking skill. An example of extrapolation is to ask students to tell what kind of person they think a certain character was based upon the character's actions in a story. Another example of extrapolation might be when children chart the growth of some plants. (transparency 2g) After the children observe and chart the plant growth for several days, they then describe a trend of further growth in the future. An even more sophisticated extrapolation might concern the trend that growth tended to level off after initial rapid spurts, so future growth will not be as dramatic as the initial growth.

To summarize, the comprehension level, Bloom's second highest, involves at least three aspects (use transparency 2c again) translation, interpretation, and extrapolation. Think for a moment with a colleague and see if you can give an example of a thinking task for each aspect. (Have participants share two or three examples of each aspect and explain why they are good examples.)

As we build higher in Bloom's levels of thinking, the application level follows knowledge and comprehension. (transparency 2h) Application involves the use of concepts or facts in particular and concrete situations. Application must be built upon a firm foundation of knowledge and comprehension. In order to apply what they know, children must recall information and understand what the information means. Application level tasks should be designed to give children a practice in transfer of learning from one situation to another. Very often problem solving situations call for application level thinking.

For example, children might solve a problem involving money for buying presents. This problem might be presented orally to first graders: (transparency 2i)

> Your daddy gives you $3.00 to buy Christmas gifts for your mommy and baby sister. You want to buy mommy a scarf which costs $2.00. How much money do you have left to spend on your baby sister?

To solve the problem, a child must recognize the numbers and understand their meanings. The child must then figure out how to use skills in operating on numbers (adding or subtracting in this case) or devise a strategy for comparing the numbers that are given. Thus, solving the simple math problem is an application level task.

Problem solving can occur in a social context, too. Suppose you have worked hard with the children and they know their addresses and phone numbers. You have led the children in discussion and experience concerning community helpers and their various roles. You could ask the children application level questions such as these (transparency 2j):

> You get separated from a parent at the grocery store. What could you do?
>
> You want to borrow a book to read walking home from school. You make a wrong turn and get lost. How can you get some help? Where can you go? Who can help you?
>
> If you lost your pet, how might you try to get it back?

(Ask the participant why these are application level tasks. What are some examples of knowledge and comprehension on which answers to the previous questions could be based?)

Bloom's fourth level of complexity is analysis. (transparency 2k) This level involves breaking down a whole into its parts or putting the pieces together to form a conclusion. Analysis level tasks are not easy for young children because they involve somewhat formal reasoning ability. However, children can cope with analysis on a very simple level. For instance, after a visit to the grocery store, the teacher might encourage the children to discuss the different parts of the store and where they might find particular items.

Analysis can also involve discovering causal relationships. Suppose that children try to grow mold on bread. They place four slices of bread on a table and leave it there. (transparency 21) They place identical slices in plastic bags and keep the bread moist. After 10 days, the dry bread is shriveled but has no mold. On the moist bread a fine crop of fuzzy mold has appeared! The children concluded that moisture enhances mold growth.

Synthesis (transparency 2m) is divergent, creative, productive thinking. In the process of synthesis level thinking, children produce ideas that are original for them or combine old ideas in new ways. When children make up stories or poems, compose simple songs, or design art work, they are working on the synthesis level. Since we have already had a workshop on divergent thinking, we will not discuss this idea further.

According to Bloom's taxonomy, the next complex level of thinking is evaluation. (transparency 2n) This level involves two steps:

1) Children set appropriate standards and then 2) judge ideas or products according to these standards. According to Bloom, casual judgements made without setting criteria are not evaluation level thinking.

   To encourage evaluative thinking, we could present children with tasks such as these:

   Let children devise some rules for a safe and healthy Halloween. Suggest various Halloween activities and let the children judge whether each is safe and healthy.

   Children's literature could provide many opportunities for evaluative thinking. Based on their criteria for reality and fantasy, children could be asked to judge

whether stories are "real" or "make believe". At the end of other stories, the students could be asked to decide if a character were good or bad, right or wrong. They must be asked to give a reason for their judgment. Teachers could encourage the children set up several criteria for what makes a good book. Then let them take turns naming books they think are good and tell how each book meets the criteria. A further step in the evaluative thinking process would be to let the children choose new books at the library and decide whether each is a good book according to the criteria.

(Ask for questions on the meaning of Bloom's levels. Try to clarify any misunderstandings.)

3. Quiz on Bloom's Levels

(Give participants handout 2o. Explain to them that they will be taking a quiz to see how well they understand Bloom's levels. Allow time to mark the quiz. Lead a discussion regarding the answers. The following comments will help you.)

1. This task is on the application level because the children use previous knowledge to solve a practical problem. If the children generate many solutions to the problem, they are also doing some synthesis level thinking.

2. This task involves simple recall; therefore, it belongs to the knowledge level.

3. As you devise criteria and use the criteria to make judgements, you are working on the evaluation level.

4. Because the costumes are original and unique, this task is on the synthesis level.

5. In this situation the children are breaking down a large task into its component parts. They are working on the analysis level.

6. This task is on the comprehension level. Children have received information in one form--spoken words. They translate this information into another form--drawing.

4. Using Bloom's Levels of Thinking in a Social Context

If you use your head, you can apply all of the levels of Bloom's Taxonomy in an ordinary conversation. Let's use the levels to find out more about each other. In a few minutes you will work with a partner. Select somebody you don't know well. Talk to the other person, and as you talk, try to use each of Bloom's levels to discover more about that person. Discuss the levels as you work to clarify your thinking about them. (Allow time for your exercise. Ask the participants to share some of their better questions and levels of these questions. Encourage them to explain why they identified each level as they did.)

5. Classroom Applications

Divide participants into groups of four or five according to subject matter preferences--math, language arts, reading, social studies, and science. Have each group plan thinking tasks using four or more of Bloom's levels. Have participants discuss their ideas, and record their best ideas on "Think Tank" cards. Allow plenty of time for participants to work and critique their use of the levels. Circulate to help and guide participants who are still having problems. After the groups have formulated their tasks, call everyone together to share the questions they devised. Be sure that participants tell the levels of their tasks and why each task is on a particular level. If participants misdesignate levels, guide them to find the correct level. Encourage participants to copy down applicable ideas for their own "Think Tank" files.

6. Work Time: Starting Language Experience Charts and Bulletin Boards for Classroom Use

Have materials for charts and bulletin boards set out. Organize participants to work individually or in pairs to start materials which will be completed with children's help in the classroom. Use handout sheet. Allow at least 30 minutes for work on two or more projects. Ask participants to bring their completed charts or notes from children's ideas on the bulletin boards to the next thinking workshop.

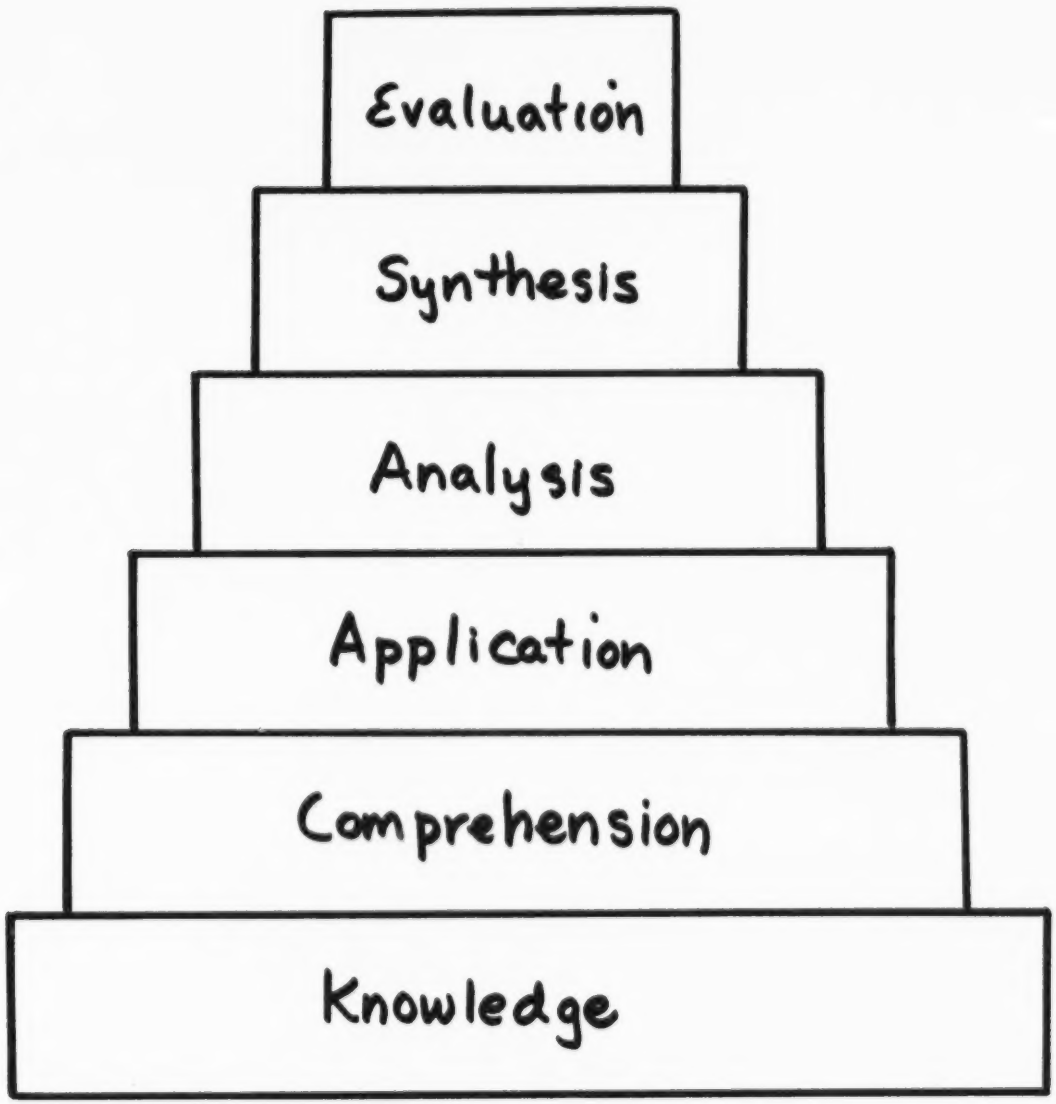
7. Assignments

We have worked on knowledge and comprehension of Bloom's levels. Now we will ask you to use the application level and employ as many of Bloom's levels in your classrooms as possible. The more you practice using these levels, the more aware you will become

of each level, and the easier it will be to apply them in the classroom in many settings. (Give participants Handout 2q) For your assignment you will need to complete numbers one, two, and nine. Choose at least two of the other options to use with your class. At the beginning of our next workshop, we will discuss the results of our assignments and your students' reactions to Bloom's levels of thinking. (Give participants time to review the assignment sheet. See if they have any questions.)

Stress the fact that participants must practice using Bloom's levels of questioning in the classroom in order to improve their own questioning skills and to refine students' thinking skills.

Bloom's Levels of Thinking



A Hierarchy

- Bloom's

KNOWLEDGE

Level

Recall of explicitly stated information-- main ideas
details
sequences
comparisons
relationships

Lets us communicate

A foundation for other levels

- Bloom's

COMPREHENSION

Level

Translation

- Interpretation

Extrapolation

-

A part of comprehension ...

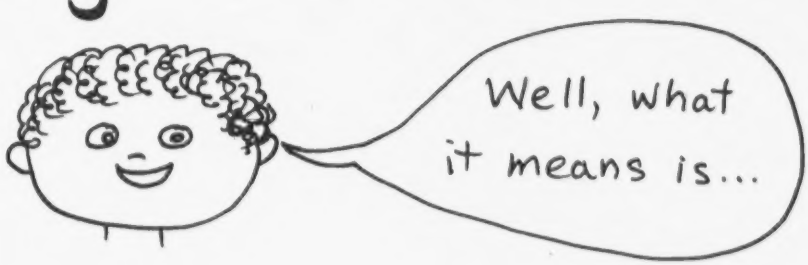
TRANSLATION

Changing information to a different form:

- Words into pictures

"the caterpillar ate a lot of leaves"

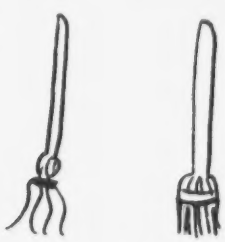
- Putting into own words



- A part of comprehension ...

INTERPRETATION

- Noting similarities & differences

- 

"Both have handles"
"One's wet. One's dry."

- Determining relationships

"5 nickels to equal a quarter."

- Giving examples

- "Here's a circle"

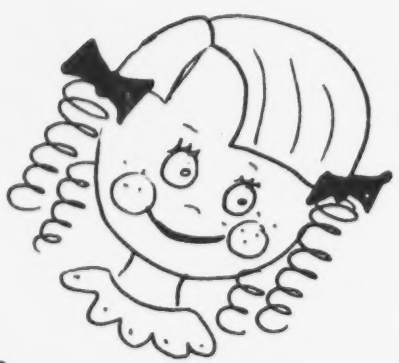
"I see a rectangle."

A part of comprehension ...

EXTRAPOLATION

Inferring from known to unknown

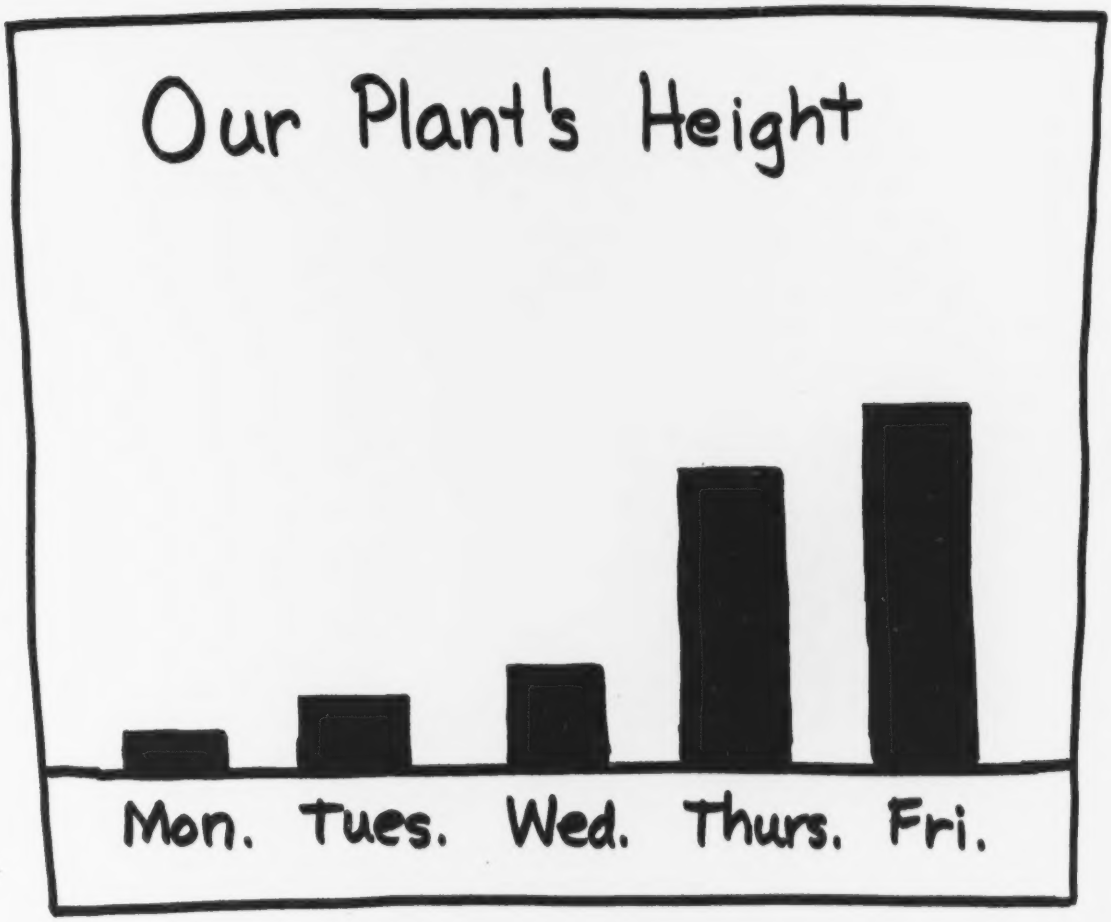
"She's happy."



"She has a friend."

"Someone likes her."

"She might feel good."


Our Plant's Height
Mon.
Tues.
Wed.
Thurs.
Fri.

Bloom's

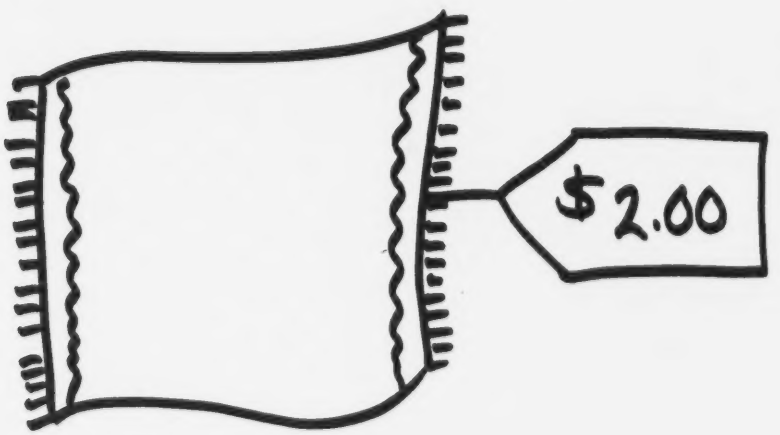
APPLICATION

Level

- Use of concepts & facts in concrete situations
- Transfer of learning
- Builds on knowledge & comprehension
- Simple problem solving

- An application level problem

Money to spend

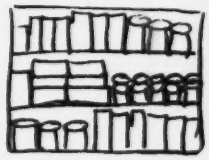


Buy a scarf

How much left to spend?

Some APPLICATION Problems in a Social Context

Separated from parent in grocery store.



Want to borrow a book to read.

Lost a pet.

Bloom's

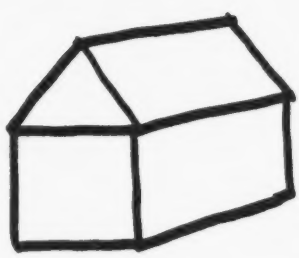
ANALYSIS

Level

- Breaking a whole into parts

"a triangle"

"a square"



"2 rectangles"

- Putting parts together to make a whole

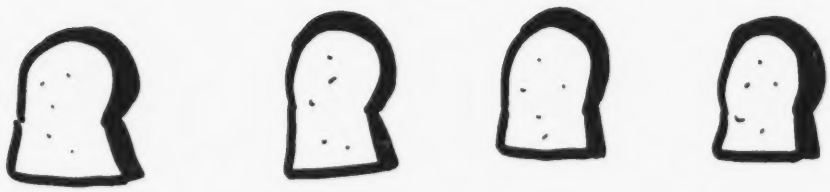
people +

buildings + roads +

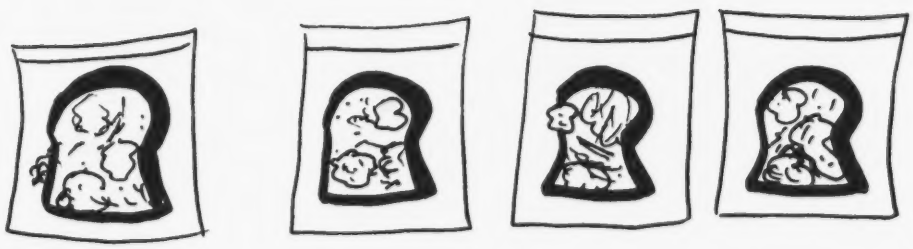
trees = our town

2k

- ANALYSIS of Experimental Results



Dry bread -- no mold

- 

Moist bread -- lots of mold

Conclusion:

Moisture promotes mold growth

Bloom's

SYNTHESIS

Level

- Divergent, creative, productive thinking
- New ideas
- Combining old ideas in new ways

2m

Bloom's

EVALUATION

Level

- Setting appropriate standards
- Judging ideas or products according to standards

2w

IDENTIFYING EXAMPLES OF BLOOM'S LEVELS

You and your kindergarten class have read the story, The Three Little Pigs. Since the children enjoyed the story and have asked for it repeatedly, you have decided to have a play and invite the parents.

Read the following thinking tasks. Mark the appropriate level of Bloom's taxonomy (knowledge, comprehension, application, analysis, synthesis, evaluation)

1. You make the pig houses out of cardboard. They keep falling over, so you work with the children to make them more stable.

2. You ask the children what the three little pigs' houses were made of.

3. You want to know if your play was "good" or not, so the children think of several characteristics of a good play. After the play is over, you go over the characteristics and decide on the success of your play.

4. Children create their own paper bag costumes for the three pigs and the big bad wolf.

5. You work with the children on the planning process for the play. They decide on all the tasks that must be completed and the responsibilities for each person.

6. After hearing the story, you ask each child to draw his or her interpretation of what each pig's house looked like.

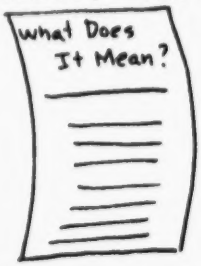
PROJECTS TO ENHANCE CHILDREN'S LEVELS OF THINKING

You will find below several activities for bulletin boards and experience charts to use in the classroom to enhance children's thinking at several levels. As children add their ideas to the bulletin board and/or language experience chart, they can share their thoughts with one another thereby developing their thinking skills beyond the knowledge level.

LANGUAGE EXPERIENCE CHARTS

Start and decorate the charts now. In the classroom, children will narrate answers and you will record them on the charts. Use your best handwriting as a model for the children.

<u>What Does It Mean?</u> (Comprehension--translation level) Entitle the chart with this caption. Use a sentence or phrase from your weekly reading material. Let the children tell in their own words what it means.



<u>Where Do We Use Numbers in Everyday Life?</u> (Application, synthesis levels) You might decorate this chart with numerals clipped from catalogs, the newspaper, or even an old telephone book. Have children narrate as many uses of numbers that they can think of. Pause occasionally to let the children elaborate on their answers, telling specific details.

<u>What Might Happen Next?</u> (Synthesis level) Choose an interesting picture related to subject matter you will be teaching. Have a group of children study the picture, then give reasonable answers of what might occur next.

<u>In Your Own Words</u> (Comprehension--interpretation level) Write the title and several vocabulary or concept words on a chart. Leave spaces for several children to dictate their interpretations of each word.

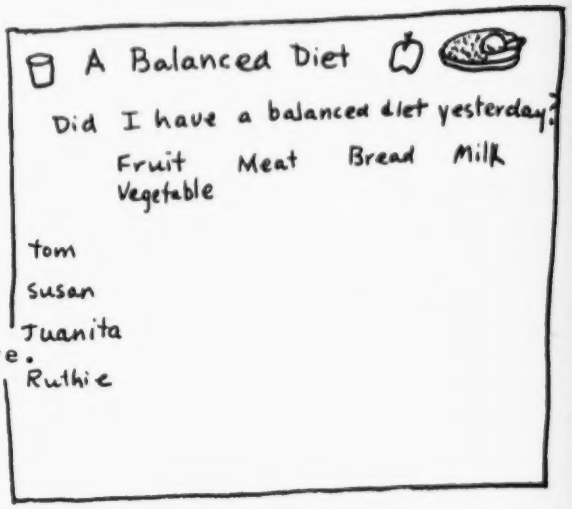
Add Your Own Language Experience Chart Idea . . . for something you could use in the near future. Start on attractive chart. Get in mind the level of thinking that you are trying to encourage in the children

BULLETIN BOARDS

These bulletin boards should be easy because once you have filled in the captions, the children can complete the rest. Make the captious now, use them in your classroom later.

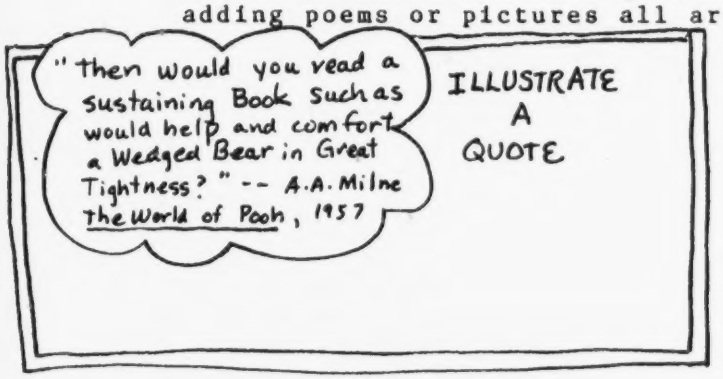
Did I Have a Balanced Diet? (evaluation)

Cut out several pictures of food products from a magazine. Be sure you have a variety from each food group. Let your students set up a criteria for what composes a balanced diet using the food pictures you have cut out. Then let each child come to the bulletin board and evaluate whether or not he had a balanced diet the day before.



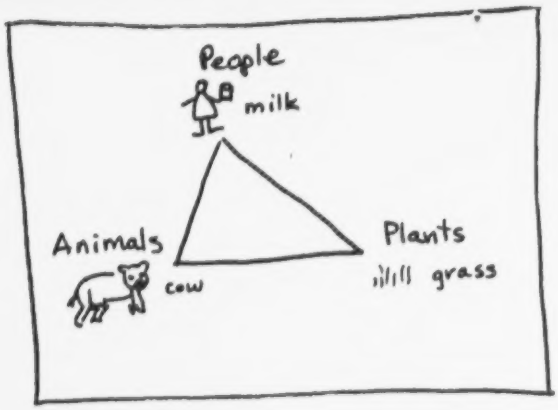
Illustrate a Quote

Take a quote from a story that you have recently read in class. Let children illustrate this quote by adding poems or pictures all around it.


"Then would you read a sustaining Book such as would help and comfort a Wedged Bear in Great Tightness?" -- A.A. Milne The World of Pooh, 1957
ILLUSTRATE A QUOTE

What Happened? (Comprehension translation level) After reading a story to the children, help them to recall and discuss important details and the sequence of the story. Now let them draw pictures to show different aspects of the story. Place these pictures in sequence, on a bulletin board.

Parts of Our Community (Analysis level) Prepare a title and captions for a bulletin board. You might use people, places, and things. Have children discuss examples in each category. Let them tell about the relationships of each part to the other parts and to the whole.



People, Animals, and Plants (Analysis, synthesis) This bulletin board stimulates the children to think about the relationships between plants and animals. Use captions as shown. Help the children to express their ideas about each plant and animal and the food chain.

Add Your Own Bulletin Board Starter. Use a topic you'll be teaching soon. Prepare a bulletin board caption and think of a task to encourage children to think beyond the knowledge level. Carry out your idea with your class.

CLASSROOM APPLICATION--BLOOM'S LEVELS OF THINKING

The following tasks have been formulated to help you become more proficient at using Bloom's levels of thinking in your classroom. Your leader will ask you to do several of these assignments. Remember the more often you use your newly found skills, the easier it will become.

1. Add cards to your "Think Tank" box. Make a divider for "Bloom's Level of Thinking." Add at least 10 thinking tasks that utilize at least three of Bloom's levels in your teaching in the next week. Mark each idea with its level.

2. For a lesson you will teach, plan to use at least four of Bloom's levels. Describe how higher level thinking tasks were built on lower level ones. Describe the children's reactions to each task.

3. Write down at least 10 questions or thinking tasks you give children in a lesson or a day. Identify the level of each task. Have you used at least three different levels?

4. Describe two different ways you might evaluate children's thinking on a level higher than knowledge or comprehension.

5. Plan a science experience where children will predict something, observe it or test it, then draw conclusions. Use at least three of Bloom's levels. Make notes of the children's reactions.

6. Plan a nonverbal synthesis level task, perhaps involving art or creative movement after the experience. Describe what you did and the children's reactions. If possible, bring some results to the next workshop.

7. Plan some thinking tasks to accompany the reading of a book in the next week. Gather some props to use to enhance the meaning of the story. Plan some activities to complement the story and have the children work on at least three of Bloom's levels. Bring the book, props, and a description of your results to the next workshop.

8. Use inductive or deductive reasoning on the children's level in a thinking activity. Here you will be utilizing Bloom's analysis level of thinking. Write a description of what you did and the children's reaction. You will share some results at the next workshop.

9. Use the materials you stated in this workshop with your class. Note your results for sharing at our next session.

WORKSHOP 3

DECISION MAKING, CONCEPT DEVELOPMENT, AND PROBLEM SOLVING

This workshop encompasses three interrelated areas: decision making, concept development, and problem solving. All are important in young children's lives. All these topics lead to later work in the middle and upper elementary grades. Children make decisions every day, both in and out of school. Concept development is essential for children's understanding of basic ideas. Children apply their knowledge and understanding as they encounter, plan to solve, and carry out solutions to problems. Adults can enhance children's development in these important areas by being conscious of opportunities to incorporate them into the existing curriculum.

Workshop Leader Behaviors

The workshop leader will conduct the following activities.

1. Lead participants in sharing the results of previously assigned classroom applications.
2. Explain the importance of decision making by young children.
3. Provide examples of decision making in the curriculum.
4. Present guides for encouraging decision making in young children.
5. Discuss examples of concepts for young children and tell why concept development is important.
6. Present some guides for developing chidlren's concepts.
7. Have participants work in groups to select a concept, brainstorm some ways to develop the concept, and share their results with others.
8. Introduce and explain the process of problem solving.
9. Provide examples of carrying out the problem solving process with children.
10. Invite participants to share other problem solving situations they encounter in their classrooms.
11. Assign work to be carried out in classrooms.

Workshop Preparation

Prepare the following materials:

Transparencies 3a through 3g.
Handout 3h.

Obtain an overhead projector and 15-20 blank notecards for each participant. Study the workshop overview and contents, adding pertinent examples of your own.

Participant Responsibilities

Inservice workshop participants will

1. Work with partners and share results of applications of Bloom's thinking levels from their classrooms.

2. Receive information on decision making, concept development, and problem solving.

3. Offer suggestions for decision making opportunities for children.

4. Work in groups to select concepts and generate ways of developing the concepts.

5. Suggest classroom problem solving situations.

6. Carry out decision making, concept development and problem solving activities in their classrooms and plan to share the results at the next workshop.

Workshop Content and Activities

1. Sharing of Classroom Applications of Bloom's Levels.

Ask participants to select partners, joining with someone from another grade level or someone they do not know well. Allow ten to fifteen minutes for partners to share their "Think Tank" ideas on Bloom's levels and classroom applications. In a large group, ask individuals to share classroom applications that worked especially well for them. Allow just five minutes for this activity. Then ask for some applications that did not work especially well. Encourage participants to help each other with ways they might have made the activities work better.

2. Decision Making for Young Children.

Think of all the decisions you make each day--what to wear, what to eat and when, what ways to teach topics, whether to watch TV or not. Think of times when you have encountered more far-reaching decisions about matters such as marriage, major purchases, or medical treatments. What are some other "everyday" or major decisions you encounter? (Solicit a few answers.)

Have you known adults who simply couldn't make decisions about trivial or important matters? Perhaps some of their difficulty stems from a lack of practice in decision making. Perhaps they were never asked or allowed to make decisions and accept responsibility for decisions when they were children. Maybe they possess few ideas for strategies for decision making.

Early practice in decision making is important. (transparency 3a) Allowing children to make decisions gives them practice in deciding matters for themselves. It conveys an attitude of trust; it tells children that we think they are able and responsible. When children make decisions, they build feelings of confidence in their own abilities; they come to see themselves as competent and valuable. As children make decisions, they also gain ideas on ways and strategies to make decisions. They learn that with most decisions, both positive and negative aspects result. If, for instance, a child chooses to watch a certain TV program, he might thoroughly enjoy the program and not miss out on the sequence in the story line. On the other hand, by deciding to watch that program, he could miss an excellent program on another channel, or he might have to forego playing ball with his friends.

3. Decision Making in the Curriculum for Young Children.

What kinds of decisions can young children make? (transparency 3b) Decision making situations exist in virtually every curricular area. Children can make narrow choices within parameters defined by the teacher. They might also have broader choices where they decide which curricular area to pursue or which way to pursue it. They can discuss the implications of their decisions and compare their decisions with those of others.

Suppose that it's time for handwriting practice in kindergarten. The children are practicing letters with straight strokes such as A, E, H, T, and K. The teacher and assistant offer a choice of four activities. (1) The children may form letters from pieces of playdough. (2) They may trace over letter patterns in sand trays. (3) They may also select pieces of yarn to arrange

in letter shapes on a flannel board, or (4) they can work with crayons on unlined paper and copy letters from models. The children are used to the teacher's simple rule for this period of the day: they must select an activity and stay with it for the 15 minute time. After the teacher describes the four choices, the children move quietly to tables and the rug area where they work on the same skills but use different media.

A third grade teacher uses each Friday's reading period for review and enrichment time. The children work with various reading games, a computer program, or have a choice of free reading during enrichment time. They respond well to the idea of choices. Once a month the teacher asks the students to decide on their favorite activities from the last Friday's enrichment time. She attempts to make the favorite activities available.

Before a county election, a second grade teacher and her assistant plan a mock election with their students. They decide on roles and materials that will be necessary for them to let the entire second grade cast mock ballots. The children choose various committees and carry out several different roles to get ready for the election, conduct the election, count the ballots, and announce the results. The teacher also conducts a discussion with her class on factors that are involved as one decides who to vote for. Throughout this social studies project, the children are involved in much group and individual decision making.

As first graders develop skills in addition and subtraction, a teacher assistant works with small groups on solving simple word problems. She presents problems orally and the children arrange flannel board pieces to represent the problem situation. The children then decide whether addition or subtraction is involved. They discuss various strategies for picturing each problem, getting an answer, and checking their results.

As children study plants, the teacher offers several experimental variables to work with. The children will work in groups of four. They decide whether they will try to grow plants using one of the following situations: dark and light, watered and unwatered, dirt or sand, fertilized or unfertilized, planted at a depth of 1 cm or 6 cm, or in a large or small pot. After the children choose a variable that interests them, the teacher and assistant help them to plant their seeds to test the variable. The teacher also asks that each group keep track of data about their plants. He shows two ways to keep charts, and illustrates two kinds of graphs the children might make. He also offers the choice of keeping track of data in ways the groups will devise.

In this situation, the groups of children make two major decisions--what experimental variable to use and what way to keep track of results. Once the decisions are made, the groups are expected to carry out the experiment and share their results with the entire group. The teacher asks the students to evaluate their choices of record keeping--discussing advantages and disadvantages.

Kindergarteners are working with two category graphs. Over a three-week period, their teacher has them mark choices on graphs for these topics:

I would choose white milk or chocolate milk.
I'd rather play ball or tag.
I choose to go to the math or language arts table first.
On Saturday morning, I like to play or watch TV.

As the children expand to making graphs with more than two categories, the children make graphs indicating their choices of leisure time activities, favorite story of the week, and favorite outdoor game. The children are also asked to decide on additional topics for graphs and categories for each graph.

We have seen that opportunities for decision making are readily available in the curriculum for young children. Let's think of some other situations in which young children can make decisions. What are some situations where you offer a choice of several learning activities? Where can children make decisions in reading or language activities? In math? In science and social studies? How could you encourage children to discuss their decision making strategies with others?

4. Guides for Encouraging Decision Making in Children.

Let's look at some guides to help you develop decision making skills in your students. Try to make a conscious effort to incorporate these suggestions in your classroom next week. (transparency 3c)

a. Plan situations where children have to make decisions. Try to plan at least one or two choices in each curricular area. Be sure your students have decisions to make daily.

b. Make fewer decisions yourself. Often it is easier for you to go ahead and make the decision yourself, but children never learn decision making unless they have practice. Stand back and let them try.

c. Don't offer choices when you don't mean it. Don't ask your children if they would like to go to the gym, when they really don't have that option. When it's time for lunch, don't ask rhetorically, "Are you ready to go to lunch now?" What will you do if someone says no?

d. Be supportive of children's decisions. Your support will boost their confidence. Remember, remarks such as, "That is good but . . ." undermine a child's confidence.

e. Be willing to go along with children's ideas even when you know they won't turn out so well. Your willingness to let children make wrong decisions says, "I trust you." This attitude will also help children to see weaknesses and strengths in their decisions. Children often learn as much from their mistakes as they do from their successes.

f. Above all, be accepting of children. Children are very sensitive to your reactions to them. Everything you do or say either says "You are acceptable" or "You are not acceptable." If children don't feel accepted by you, they will not trust you enough to offer ideas on decision making at all.

5. Concept Development and Its Importance.

Concepts, or main ideas, are what we think with. (transparency 3d) Concepts are building blocks of intellectual functioning. Both children and adults use concepts to learn from and understand the communications of others. Without having an idea of what "adding" means, children may not know what to try to do with sets of objects. Addition facts are meaningless trivia to be memorized. Unless they understand the concept of "alphabetical order," children can't find words in a dictionary or put names in alphabetical order.

Knowledge of many concept words enable children to follow directions and pursue intellectual tasks. Color words; relational words such as equal, larger and smaller; hotter and colder; and directional words such as above, below, right, left, and in the middle, are examples of important concept words for young children. In the early elementary years, children also develop concepts in areas such as time, number, measurement, causality, and social relations.

Concepts are often group class names such as hard or soft, smooth or rough, magnetic or nonmagnetic, or plants and animals. To deal with classes, children must respond to specific instances

and see whether or not each instance is a member of the class. For example, if they are dealing with the concept yellow, children might examine various articles of clothing and decide whether each fits into the class of yellow things or not. As they mature, young children are increasingly able to deal with class concepts. They refine concepts as they examine more and more instances of members of classes.

It is easy to see that concept development is basic! Concepts provide the very foundations on which much school work and intellectual functioning are based. Without concepts, language is meaningless.

6. How Can We Help Children Develop Concepts?

Young children need concrete experiences if they are to develop concepts effectively. Language, from both children and adults, should accompany experiences to help children develop meanings. Some guides to concept development are: (transparency 3e)

a. Use many examples and nonexamples. For example, when teaching about the meat group, one of the four basic food groups, show pictures of many meat group members. Also, show several foods that aren't meats.

b. Let children offer examples and nonexamples. Invite children to tell about foods they think are meats and foods that don't belong to the food group. Have them clip their own pictures or make a list of meat and nonmeat foods used in their homes.

c. Approach concepts in many ways with activities that appeal to different learning modalities. Cook and taste samples of actual foods. Encourage children to touch foods with clean hands and smell them. Listen to the sizzle of frying hot dog bits. Read a story about fishing. Make a mobile of attractive meat pictures. Visit the meat section of a supermarket and talk with the butcher. Prepare and taste an ethnic meat dish.

d. Provide materials that children can manipulate and activities that children can participate in. When developing concepts about the fruit and vegetable groups, provide actual foods for the children to

feel and arrange in order from smallest to largest or lightest to heaviest. Notice which fruits and vegetables are smooth, shiny, bumpy, or juicy. Peel fruits and vegetables. Most will have seeds to examine and compare. Sing "The Farmer Plants a Seed" to the tune of "The Farmer in the Dell," adding verses on the farmer grows a plant, and so on. Let children color reproduced fruit and vegetable pictures.

e. Encourage children to create their own representations of concepts. Through pictures, words, models, drama, creative writing, and other expressive forms, children refine their understanding of concepts. When studying another food group, breads and cereals, children might draw pictures of their favorites. They could grind some dry corn in a blender, then verbally review the process. They might act out bread dough being mixed, rising, and being baked. They could write a story or advertisement for a specific bread or cereal. What other expressive forms might children use to sharpen their concepts of the bread and cereal group?

7. More Examples of Concept Development.

Let's work through these guides for some concepts you are dealing with in your classrooms. (Organize participants into groups of three or four; perhaps grade level groups will work well for this activity.) Choose a main idea or concept from something you'll be teaching in the near future. Work ways to carry out at least three of the five guides for concept development. (Use transparency 3e again.) (Give groups 10 to 15 minutes to work, then lead a sharing of ideas. Keep the discussion moving, but allow participants to add ideas to those offered by each group.)

8. Problem Solving for Young Children.

Now we're ready to examine another aspect of children's thinking: problem solving. People are involved in problem solving throughout their lives. We deal with social problems, ethical problems, and most of us face monetary problems almost everyday. For young children, problem solving might encompass dealing with physical objects, number or spatial problems, interpersonal problems, and even problems of self-control and self-regulation.

Problem solving involves the application of known facts and skills to new situations. When a person knows the answer or solution to a situation immediately, the situation really has not

presented a problem. Rather, problem solving usually involves a process of preparation or clarifying a problem, deciding on ways to solve it, carrying out the solutions, and checking to see that the solution is workable. George Polya stated the steps to problem solving as: (transparency 3f)

Understand the problem.
Develop a plan to solve it.
Carry out the plan.
Look back and evaluate your solution.

Reys, Suydam, and Lindquist (transparency 3g) paraphrased Polya's phrase with four key words--see, plan, do, and check. Riedesel (see third column on transparency) adds an additional element to understanding the problem--decide on what is given and decide on what is asked.

9. Carrying Out the Problem Solving Process. How do young children begin to understand problems? They might talk about the details of a problem. They could act out a problem situation or draw pictures of it. When a teacher breaks up a fist fight, in attempts to clarify the situation, the teacher typically asks, "What's the problem? Why are you fighting?" Often, as children explain their reasons, they begin to understand each other's point of view. Sometimes the problem is defused by a simple discussion of what the problem is. If second graders tackle a problem of using newspaper ads to plan the "purchase" of at least five grocery items for under ten dollars, they must comprehend the two parameters that are involved--the $10.00 limit and the "at least five items" requirement.

Developing plans to solve problems is a creataive process. Research has proved the old adage "two heads are better than one" to be true. When small groups of children work together on problem solving, they have been shown to solve more problems than working individually. At times, even a large group can brainstorm solutions to problems. Perhaps children are studying dental health, but the teacher has reason to believe that many children do not brush their teeth regularly. In a large group discussion, the children mention several ways to remind themselves to brush. They mention making charts for themselves and marking them each morning and evening, bringing toothbrushes to school and brushing after lunch, rewarding themselves if they brush at least twice a day for a week, or reminding each other to brush in a "buddy system." The group also uncovers the problem that some children don't have toothbrushes and toothpaste. Different solutions appeal to different children, but the group decides to make brushing charts, brush after lunch, and that each child

will also use one other method. The teacher promises to obtain brushes and paste from the health department for each child who needs them.

The next step in the problem solving process is carrying out the solution or solutions that have been chosen. In math problems, it might involve doing computations. If fighting children have agreed to apologize, and not call each other names again, they must carry out these actions. In the case of tooth brushing, the children plan to try the procedures they chose for two weeks and keep track of the results. Carrying out solutions may extend over a period of time or may be done in a few minutes.

The final step in problem solving involves evaluating the solution. If a child's problem has been how to present a book report in an interesting way, the child can evaluate the effects of her technique in several ways. She might try to notice whether her classmates listened to her report or asked questions. She might see whether classmates read the book she reviewed. The child could ask friends or her teacher what they liked about her report and how she might have improved it. As kindergarteners solve problems in block building, the solutions are often evaluated in nonverbal ways--Do the structures stand up? Do they look the way the children had intended? To evaluate the solutions to the toothbrusing problem, children can see the proportion of classmates whose toothbrushing habits improved in the two week period. As part of the evaluation process, children might also think about other methods of problem solution. Could they have carried out solutions in other ways? What might the results have been?

10. <u>More Problem Solving Situations for Young Children</u>.

What are some other problem-solving situations you could encounter in your classroom? How might you apply the four-step problem solving process to them? (Invite participants to suggest at least three or four problems and let others suggest how the problem solving process could be applied. Lead participants to deal with at least one social problem and several problems children encounter in the curriculum.)

11. <u>Classroom Application Assignments</u>.

Distribute handout 3. If time permits, let participants work together on "Think Tank" cards. Assign an appropriate number of tasks under each subheading. We suggest at least one classroom application of decision making, concept development, and problem solving in addition to preparation of "Think Tank" cards.

CLASSROOM APPLICATIONS

DECISION MAKING, CONCEPT DEVELOPMENT, PROBLEM SOLVING

We've examined development of children's thinking skills through opportunities for decision making, concept development, and problem solving. To develop your competencies in these areas and to enhance children's experiences, your workshop leader will ask you to carry out assignments from the following choices before the next workshop.

Add to your "Think Tank" box at least five ideas for each area: decision making, concept development, problem solving.

DECISION MAKING

1. Plan a decision making experience where children will graph their decisions. Bring the graph to the next workshop.

2. Find a story in which a character makes an important decision. The story might be about a historical character, or it might concern a choice about interpersonal relations. Read the story to your children. Let them discuss the decision that was made and its results. Let them tell what decision they would have made in a similar situation. Record notes about the story and the children's reactions.

3. Plan a period of an hour or more where children can choose and work with a learning activity. You might solicit the children's ideas of some favorite activities or plan the choices of activities yourself. Decide on rules for the "choice time"--Can children rotate and participate in several activities or must they choose an activity and stay with it? Bring materials for some of your choices to the next session. Note the children's responses. Evaluate the experience both in terms of what the children learned in the activities and what they learned about decision making. Plan a summary of the experience for the next workshop.

4. Plan and carry out an opportunity for children to make decisions in any area or topic you normally teach. Plan to report to your colleagues in the next workshop by telling about the experience, showing materials, and describing the children's responses.

5. Ask the children to think about a decision that they have made within the past week. Let them tell about the results of the decision, whether they think the decision was the best one and why. Choose three especially interesting examples to share with your colleagues in the next workshop.

CONCEPT DEVELOPMENT

6. Choose at least two concepts your students must deal with. Develop each concept and plan at least three different experiences for children. The experiences should include the senses of sight, hearing, and touch. If you can, also include the senses of smell and taste. Write up the experiences and children's reactions. Bring materials to share at the next workshop.

7. Choose at least two concepts that are especially suited to developing by using examples and nonexamples. Plan some examples and nonexamples to share with your students. Invite the students to suggest examples and nonexamples, too. Make an experience chart of your results. Share the chart at the next workshop.

8. Choose at least two concepts to develop by means other than sensory experience or examples and nonexamples. Note how you approached the concepts and the children's reactions. Bring appropriate materials to the next workshop for sharing with colleagues.

PROBLEM SOLVING

9. Choose at least two problem solving situations that will be encountered in your classroom. For each, plan ways to carry out the four steps of the problem solving process. Write a summary of the ways you carried out the process. Plan a way to report to your colleagues at the next workshop.

10. Choose at least two problem solving situations where small group work in the "planning how to solve" stage would be appropriate. Plan and carry out small group activities. Make notes of your strategies and results. Note any classroom management techniques that worked especially effectively or areas where behavior management might have been improved.

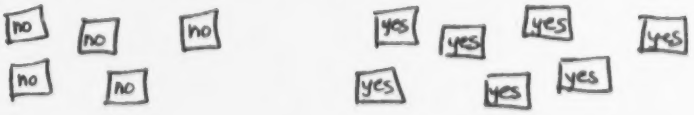
11. Research shows that children progress well in problem solving if they have many opportunities to suggest or write their own problems, then solve them. Apply this idea in at least two class periods. In math, for example, children could write word problems on cards, exchange the cards, and work each other's problems. For an art activity, children could cut paper shapes, exchange them with classmates, then have the classmates incorporate the shapes into a drawing or design. Note the activities you did, your ways of sharing or distributing problems, and the children's reactions.

- Importance of DECISION MAKING for Young Children

- Practice in a needed skill
- Conveys an attitude of trust & responsibility
- Development of decision making strategies
- Balancing pros and cons

DECISION MAKING Opportunities in the Curriculum

- Choices of learning activities to practice skills
- Planning class projects
- Voting

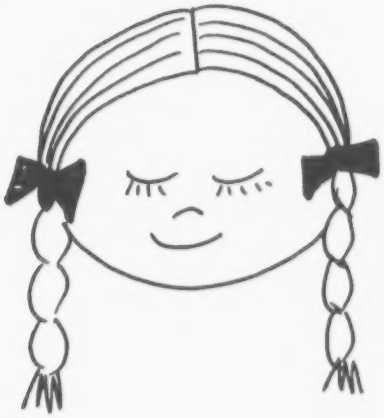


- Choices of operations in math problems
- Choices of variables in science experiments.
- Choices of ways to picture data.
- Marking decisions on graphs.

GUIDING CHILDREN in DECISION MAKING

- Plan opportunities -- at least one or two daily.
- Make fewer decisions yourself.
- Don't offer choices when you don't mean it.
- Be supportive of children's decisions.
- Let children learn from their mistakes.
- Be accepting of children

- CONCEPTS



- Main ideas
- Meanings, understandings
- Relationships
- Ideas of time, number, causality, social relations
- Group or class names

CONCEPT DEVELOPMENT

- Use examples & nonexamples.
- Have children offer examples and nonexamples.
- Approach concepts using different modalities -- sight, hearing, touch.
- Use manipulatives & experiences.
- Encourage children to represent concepts.

• PROBLEM Solving

Polya's four steps

- Understand the problem
- Develop a plan to solve it.
- Carry out the plan
- Look back and evaluate your solution.

PROBLEM Solving Steps

Polya	Reys, Suydam, Lindquist	Riedesel
Understand the problem	See	Decide what is given Decide what is asked
Develop a plan to solve it	Plan	
Carry out the plan	Do	
Look back and evaluate your solution	Check	

WORKSHOP 4

GENERAL QUESTIONING AND EVALUATION STRATEGIES

The workshop will deal with general techniques for asking good questions. We will explore creating a classroom atmosphere to encourage thinking and some general guides for asking good questions. Then we will review two specific questioning strategies: those of Hilda Taba and Mary Budd Rowe. Next we will survey general questioning strategies. Finally we will look at two aspects of evaluation in relation to questioning strategies: evaluating student progress and evaluating teacher's effectiveness in asking questions.

Workshop Leader Behaviors

The workshop leader will conduct the following activities:

1. Lead participants in sharing results from the previous workshop.

2. Overview content of this workshop.

3. Discuss creating a classroom atmosphere to encourage children's thinking.

4. Divide participants into small groups (8-10) for role playing and practicing techniques for establishing a climate conducive to thinking.

5. Discuss general guides for good questioning techniques.

6. Explain Hilda Taba's questioning strategy and Mary Budd Rowe's questioning strategy.

7. Divide participants into groups of five for planning and practicing questioning strategies-both general strategies and the specific strategies of Hilda Taba and Mary Budd Rowe.

8. Share tips for evaluating students quickly.

9. Discuss methods teachers may use to evaluate their own teaching effectiveness.

10. Suggest several classroom applications for participants to carry out before the next workshop.

Workshop Preparation

Prepare the following materials before the workshop:

Transparencies 4b and 4d through 4i, 4k through 4p
Handouts 4a and 4q

Duplicate and cut apart task cards from pattern 4c for participants to use in role playing (activity 4).

Duplicate and cut out apple symbols from pattern 4j. You will need one apple for each group of four participants to use in this activity.

Obtain an overhead projector and screen. Carefully read the workshop overview and contents.

Participants' Responsibilities

Inservice workshop participants will:

1. Demonstrate understanding of material on questioning and evaluation strategies by applying information in small group settings and evaluating each other's use of questions.

2. Carry out questioning and evaluation strategies in their classrooms and share their results in the next workshop.

Workshop Content and Activities

1. Sharing of Classroom Applications Related to Decision Making and Problem Solving

   Ask participants to divide into groups of four, joining with people from the same grade level. Allow approximately fifteen minutes for each participant to share with groups his or her classroom application experiences with decision making, content development, and problem solving. Allow time for participants to post on the wall graphs or any other visuals resulting from their assignments. In a large group, ask individuals to tell about ideas that were especially effective in their classrooms. Allow five minutes for them to share. Now allow five more minutes for participants to discuss problems that they encountered. Ask others to offer suggestions for solutions.

2. Overview for General Questioning and Evaluation Strategies

   Because you have been practicing different questioning techniques in your classroom each time, you should by now be familiar with

a wide variety of techniques for extending children's thinking. There are some general guides that apply to all the levels of thinking. In order to ensure quality mental functioning in these areas of thinking, we will discuss ways to establish a classroom atmosphere that is conducive to thinking. This session will also cover some general guides for asking good questions. Hilda Taba and Mary Budd Rowe have conducted extensive research on questioning strategies. In this session we will discuss both of their strategies.

Evaluation is the basis for improving questioning techniques. No one can improve without a careful observation of his or her strengths and weaknesses. This session will include ways to evaluate students' responses to questions and methods for evaluating the quality of teachers' questions.

3. Creating a Classroom Atmosphere to Encourage Children's Thinking.

You might ask many excellent questions to provoke thinking at various levels. You may apply all of the right techniques mentioned in the previous sessions, but still draw stoney silences from your students. How many of you think that your questioning techniques have improved considerably since you started participating in this workshop? How many of you feel that you still have relatively fewer responses than you would like from your students? What problems have you encountered? What might have gone wrong? Remember in defining problems, we are going through the first step of problem solving. Let's share some of the problems we have had and generate some suggestions for solutions. (Take time to let participants identify their problems with student responses and to offer solutions.)

Often you can multiply student responses by making a few minor changes in the general environment in the classroom. Let's look at some things we might do to set a classroom atmosphere that stimulates children's thinking. (Pass out handout 4a. Encourage participants to make notes on the handout as you explain each of the main ideas. Use transparency 4b to guide your discussion.)

a. Model behaviors that involve a variety of in-depth thinking skills.

One of your most effective techniques for teaching will be modeling the behavior you wish your students to assume. Students learn best from what you do rather than what you say. If you wish your students to learn high quality thinking skills such as decision making, problem solving, or thinking

at many of the levels designated by Bloom, you must consciously model each of these thinking skills. Often you will want to verbally state which thinking skill you are using. When you label behaviors, students become more aware of them.

b. Involve all students and demonstrate that you value their answers.

A good technique for getting high student involvement is to make statements such as this one, "I'd like to ask you a question. Everybody get ready to answer it. I'll give you a few minutes to think about it." With this method you have involved every child. No one can put his mind "in neutral" and wait for the class "brain" to solve the problem. Every child has to prepare for a possible solution. After your children have put forth time and effort to think of ideas, allow time for them to contribute many of their answers. In this way you are giving your students the strong encouraging message that, "Your ideas are worthwhile!"

c. Tolerate some complexity and disorder.

Although it is vital to give clear instructions when guiding children through various thinking skills, you will have to be willing to tolerate some ambiguity and disorder as children work through these processes. William Purkey says, "If it's worth doing, it's worth doing poorly." What Purkey means is that few people start at the top. When we first begin to learn a new skill, we make many mistakes and encounter more failure than successes. Nevertheless we must begin or we can never learn at all. Remember that your students are beginners. Allow them to make mistakes. "Getting in the game" is the first step to success.

d. Use mistakes as ways to help your students improve.

Often our mistakes can provide as valuable a lesson as our successes if they are presented in a positive, restorative context. For instance, a teacher might say, "I like that point you made, but it's not complete yet. What can we add to it?" or "It's OK to make a mistake. How will we ever learn if we don't try? How can we benefit from this error?" Don't cover up or ignore errors. Students won't know that they are wrong if you don't tell them. Nevertheless when responding to errors, do it without putting your students down. Remember criticism in small doses will be easier to digest. If children are doing poorly in many ways, pick only one error to work on at a time so they don't become discouraged and give up.

e. Build a climate of respect and acceptance; let students share, develop, and learn from each other.

Children will begin to share, respect, and learn from each other's ideas as you demonstrate an acceptance of their ideas. Try to demonstrate the attitude that "Every person is valuable, and we can learn something new from every person who comes our way." Help children understand that we don't have to fully agree with people to learn new ideas from them. Demonstrate this attitude by your acceptance. State it many times as problems arise. Give children time to work in large and small groups to practice sharing, respecting, developing and learning from each other's ideas.

f. Encourage and use activities that require multi-level thinking.

Keep a mental list or a visible checklist of the different thinking skills. Make an effort to incorporate many of them in your lessons daily. Check those skills that you use less frequently, and make conscious effort to plan activities that allow children to use those particular skills. As children begin to use the various thinking skills in class, practice becoming a good resource person, facilitator, and provider rather than a controller. Remember once children get started practicing the mental functioning skills, all they will need from you might be time and freedom for refining their skills.

g. Adapt to individual interests and ideas whenever possible.

Whenever you teach any new skill, you should try to base it upon your students' interests. Building upon current interests not only motivates students, it increases the rate of their learning and their degree of mastery. Be sensitive to your students. Know what their interests are. Build your lessons around these interests and ideas and you will have a natural motivator.

4. Group Work to Practice Establishing Positive Climate

We can establish a classroom climate conducive to thinking as we consciously practice each of these suggestions when we teach. Let's set up some mock classrooms and practice using each of these guides. (Divide the participants into groups of 8-10 people. Have each group prepare to role play a class session with a simple

lesson that has possibilities for some good questions in it. They should choose their subject. Perhaps some participants will suggest a lesson that was particularly successful in their class in the past week. Half of the group will be the leaders or teachers and the other half will be antagonists or students. Give three of the "students" separate tasks to role play. (From pattern 4c) One "student" is to consciously make a mistake (guide 1) as the leaders question the "students." Another "student" is to set up a situation that challenges the "teachers" to show respect and acceptance of his ideas demonstrating that we can learn something new from every person (guide 2). The third student is to show a strong interest in a particular area to see if the "leaders" will be flexible enough to incorporate that individual's interest. (guide 3) Throughout the mock classroom session the "teachers" should take turns practicing using each of the guides and the "students" should create situations to give the teachers opportunities to practice. Allow fifteen minutes for each of the groups to role play their lesson and five minutes for the groups to evaluate their lesson noting where they were strong and suggesting ways they could have improved.)

5. General Guides for Good Questioning Techniques

Just as the classroom atmosphere will influence students' thinking abilities, so the questioning techniques we use can either be conducive to thinking or work against it. Why do some questions draw many responses and others so few? What makes good questions? (Transparency 4d) Authorities tell us that good questions are clear. Clarity helps students focus and maintain their attention; whereas, vague questions result in wandering minds and wasted time. Good questions are often brief. Usually the longer the question is, the more muddled or confused it becomes. Another important characteristic of good questions is that they are purposeful. By carefully planning our questions, we can direct students' thinking in a spiral direction, rather than in circles. Questions planned with a purpose will generally start on a simple factual level and progress to higher, more complex levels of thinking. Good questions should be natural. The language should be on a child's level of understanding rather than stilted "text-book" language that often blocks thinking. Above all, good questions should be thought-provoking. They should tantalize and invite the listener to participate, to clarify his ideas, to analyze the existing facts, and to do more than just remember the facts--to actually use them. Thought-provoking questions challenge children.

We've seen some characteristics of good questions. What are poor questions like? Let's look at a few of those qualities. (transparency 4e) Yes-no questions are usually considered to

be bad questions because they are very unproductive. They lead nowhere because they require little thought. Groisser suggests that "tugging" types of questions can be counterproductive. Tugging questions are those in which the teacher pulls and pulls to elicit student participation. He states that these questions usually become nagging and intimidating in tone, and that teachers often get better results by asking new questions or by asking other students the same questions. In spite of their negative potential, tugging questions asked for the right purpose can be very productive. If teachers are trying to get students to think in more detail or to practice using a new thinking skill, "tugging" questions are often helpful. "Tugging" questions are more appropriate to use with small groups of individuals, especially with children who are shy and non-expressive. Whenever using "tugging" questions, be sure that they aren't intimidating in nature.

Authorities tell us that guessing questions are also unproductive. These questions really don't require any thought. Leading questions are also considered poor questions because the teacher already hints at the answer he wants, thus allowing students little opportunity to use their own thoughts.

We've seen some qualities of good and bad questions. Now let's look at some general guides for asking good questions (transparency 4f).

a. Distribute questions widely within the class. Don't just call on your smarter or more verbal students. All students need opportunities to practice thinking skills. The more students practice using these skills correctly, the better they will become.

b. Phrase questions to the entire class. Then call on individuals to respond. Say, "I'm going to ask you a question. I want everybody to think of an answer." Then, "Susan, what is your answer?"

c. As a rule state your questions only once. This technique will discourage wandering minds. If your students know you will always ask a question two or three times, they will get in the habit of being inattentive.

d. Avoid repeating student responses. Repetition encourages students to tune out remarks from their peers and accept only the teacher's word.

e. Instead, build upon student responses to extend thinking. For example, when children are describing the weather for their daily weather chart and Hayley says, "It's a rainy

day." The teacher builds upon Hayley's response with, "What kind of rainy day is it? Think of some words to describe this rainy day." Give feedback concerning responses.

f. Use student responses to make decisions about subsequent classroom activities. These responses will be a good guide for determining the students' level of achievement, their interests, and needs.

g. Use feedback from your students to judge the effectiveness of your questioning strategies. Monitor what the students say as a gauge of your clarity and effectiveness.

h. Plan questions in advance so that they relate directly to your objectives. In planning questions, be sure that you have a well balanced variety of questions to elicit many types of thinking skills. Make sure that your questions are clear.

6. Two Questioning Strategies: Taba and Rowe

We have discussed establishing a classroom atmosphere conducive to thinking and asking good questions. Now let's look at two specific questioning strategies. These strategies should give us a few more helpful hints for refining our questioning techniques.

Hilda Taba's Questioning Strategy (transparency 4g)

Hilda Taba's Questioning Strategy includes a step-by-step process in which students move from low-level responses to more complex levels of thinking. In step one, the teacher asks an opening question that can involve all students. This question should be open-ended and allow for many responses. The teacher should use this opening question time to establish the focus of the discussion.

Step two involves lifting questions. In this phase students move beyond factual knowledge to higher levels of thinking in which they must offer their opinions based on the facts and show relationships. Lifting questions might begin with such phrases as, "What do you think?" or "What seems to be?" or "What might be?" For example, you might ask, "What do you think will happen if we drop this bag of cotton and this bag of sand at the same time?" or "What seems to be the best way to determine which is the head of the earthworm?"

In step three the teacher asks questions that require students to make generalizations. Here students must build upon ideas already presented and draw conclusions. Appropriate starters

for generalization questions might be. "What did you learn . . .?" or "Why do you think . . .?" Let's look at an example of Hilda Taba's Questioning Strategy in a class. Suppose a blind adult has visited the class and shared his experiences with coping with his handicap. After the visit you might ask for opening questions such as, "How did you feel about Mr. Barnard's visit? What are some things Mr. Barnard told you?" After several responses, you might move to lifting questions by asking, "How are you and Mr. Barnard alike? What ways are you different? How do you think he felt about being blind?" Then you can draw students to the generalization stage by asking questions like, "What did you learn about blind people today?If you were blind, how would you help yourself? How might you be helpful to a blind person?" Thus we see students moving from a simple level of thinking into a step-by-step progression through more complex levels of thinking.

Mary Budd Rowe's Questioning Strategy

Mary Budd Rowe (transparency 4h) discovered that there was a relationship between the number and quality of students' responses and the length of wait-time between questions and responses. She explored the wait-time factor with many small groups of students and found that the average length of wait-time that teachers allowed from the question to beginning student responses was between one and two seconds before they responded to a student's statement. In the study when teachers increased their wait-time in both instances, students gave more responses and longer responses. More students initiated responses and the quality of their answers improved. From this study we could learn to tolerate silence after we ask questions in order to improve the quality of our students' responses.

7. Group Work for Practicing Questioning Strategies

We've discussed many important principles related to good questioning strategies. Now let's divide into smaller groups and practice using some of these principles. We will pretend that each group is a classroom of students. You have just read a fairy tale or folk tale to your class, and now you are ready to ask questions based upon your story. Divide participants into groups of five, and let them practice being the "teacher" in their group and asking questions incorporating the strategies they have just learned. Place transparency (4i) on the overhead projector to give participants a quick reference for the questioning strategies. Give each group an apple card pattern 4j. Whenever any participant has a good idea for a question to ask, he or she must take the apple to signify that he or she is the

"teacher". Everyone in the group must take at least one turn being the teacher and incorporating the different strategies in their questions. Encourage your participants to also include Taba's and Rowe's strategies in their questions. The rest of the group should also try to identify which particular strategy the "teacher" is using.

8. Evaluation

Evaluation is the essential element that gives purpose to our planning. (transparency 4k) Evaluation helps us to know where we are, what we have actually accomplished, and what we should do next. Without the appropriate kind of evaluation we might move along quite rapidly, but our progress and destination will be left up to happenstance. In considering evaluation, we need to consistently make use of the two types of evaluation: evaluation of student progress and evaluation of teacher effectiveness.

Student Evaluation

No lesson plan is complete without plans for evaluation. Teachers need to determine and specify the materials and procedure for assessing student progress in thinking. Evaluation procedure can become unwieldy unless teachers establish shortcuts. Learn to make quick checks. (transparency 41)) Whenever possible choose quick signal tests rather than elaborate evaluations that involve lots of grading.

One rapid testing procedure might be for each child to have an answer packet which contains strips of paper with the right answer. The teacher asks questions and each child holds up the right answer. In this way the teacher can tell at a glance which children know answers, which ones show that they are unsure by looking at other students, and which one definitely don't know the answers. If the answer is more involved, let students write an appropriate answer on a slip of paper and hold it up.

Madeline Hunter suggests another fast checking procedure: signaling. When signaling answers, children can make a cross with two fingers for "yes" or "true" answers, and minus with one finger for "no" answers or "false" answers. Students can hold up fingers to indicate number answers. Students do not have to give all of the digits in a number answer to show whether or not they known an answer. For example, they might hold up fingers indicating the answer to the number in the ones place when you multiply 3x7. Perhaps the teacher wishes to determine

if the children understand the concept of which numerals are larger. He or she asks, "Is the first number larger or smaller than the second number?" Then the teacher calls out "15-12." The students must signal with their fingers > or < indicating larger or smaller with each problem the teacher calls out. Here is another example of a signal check. Suppose your class has studied farm animals and you wish to conduct a quick signal check to test their concept development. You ask the children to signal true or false to the following questions. "Cows have cloven hooves. Turkeys have waddles hanging from their necks. We can drink milk from goats."

"Partner checks" is another type of quick check which could be very effective for more involved answers but not as revealing to the teacher. The teacher states a question and asks each student to solve the problem and tell his answer to his partner. The teacher in turn asks each student to raise his hand if his partner had an appropriate answer. Then the teacher takes a short time to hear some of these answers. The method utilizes Bloom's evaluation level of thinking, because the student evaluators must judge answers according to a criteria that the class sets. Another type of "partner check" is a quick written evaluation in which students evaluate each other's test.

In making quick checks, teachers need to remember two basic points. First, the purpose of quick checks is not to get a grade for the student. The purpose should be to find out where the student is and if he needs to spend more time on the particular topic or if he is ready to move on. The second point is that even the most complicated thinking procedure can usually be evaluated with quick checks. The crux lies with the way you state the question. By careful planning you can phrase questions where children must really think to arrive at answers, yet the final solution might be stated rather simply. For example, after the story of <u>The Three Bears</u>, you might ask, "In one short sentence tell me what Goldilocks learned." In this question you are asking students to identify the theme of the story. Here is another example where children have to use critical listening skills yet the final solution is quite brief. Seven pictures are posted on the board. The teacher describes one of the pictures. The children hold up the number of fingers to show which picture the teacher is describing: the first, second, and so forth. Problem solving situations might be stated rather briefly. The teacher might ask students to draw a placard to defend no homework. They are allowed to use only three or four words, but their words must be convincing. In solving the problem, the students must apply persuasive writing

skills Phrasing questions for quick checks will demand good problem solving and creative thinking on your part.

One important phrase of proper evaluation is well-organized record keeping. The purpose of keeping up-to-date records is to get a clear, overall picture of what each student has mastered and where he is still having problems. This picture will determine how you will group your children and what you will teach next. As in evaluations, record-keeping does not have to be elaborate. Check lists are often sufficient.

Using Evaluations to Plan

Teachers may have detailed information on students' progress and their needs. They may know exactly where each student is. Nevertheless, this information will be worthless and the effort spent in testing a waste of time if it is not used for future planning. Madeline Hunter equates learning with moving up steps. A student must obtain his balance on each step before he is ready to take the next step. Some students move more rapidly than others. Many of your students will be on different steps. It is pointless to ask a student to come back down to step one when he is already on step four. Neither does it make any sense to ask a student to hurry and run on up the steps when he hasn't yet maintained his balance on step two. Avoid pushing on because the content area must be covered by a certain time. This tactic accomplishes nothing but a distaste for learning and an overwhelming sense of inadequacy. It is necessary to know each of your students and where they are before you can accurately plan for them. Thus effective teachers are like good doctors. They evaluate, they diagnose the situation with its strengths and weakness, and they prescribe the next move based upon the evaluation. Your evaluations determine if you have adequately taught the thinking skill in question or if you need to give it more time and practice. Your evaluation results will also help you determine how you will group your students for the next learning stage whether in large groups, smaller clusters, or individually.

9. Teacher Evaluation

As important as student evaluations are, teacher evaluations are just as necessary if teachers are to continue to polish their teaching skills and become more effective instructors. Teachers can employ several techniques to check their own effectiveness, or they may use feedback from others to evaluate their teaching effectiveness.

One helpful way teachers can evaluate themselves is with a short written self-checklist to be answered soon after instruction. (transparency 4n) One of the most important questions to be answered in a checklist is, "Did your instruction achieve your objectives?" For example, if you were trying to get your students to refine their problem solving skills, did you adequately explain the steps? Did you give every child ample opportunity to practice the skill? Did you provide adequate feedback on problems students encountered as they work? Did you help students evaluate their progress in problem solving?

Another checklist that would be helpful to use in every lesson is one to help you observe the different types of questions you ask in each lesson. (transparency 4n) You might ask yourself, "Did I ask questions giving students an opportunity to think on a variety of levels? Which level questions did I use? Did I model a variety of thinking techniques in my teaching? Which levels did I model?" You might wish to audiotape or videotape your teaching periodically to get an accurate evaluation of yourself in action. Use audio and video tapes to help you answer your checklists.

Another indication of the effectiveness of your teaching is your grade book or the tests you have given your students. (transparency 4o) After grading the test, go back and see the questions most students had problems with. Then try to determine what in your instruction could have effected this weakness and how you might adjust your instruction to make the problem area clearer.

The above ideas have included ways teachers could evaluate their own teaching effectiveness. Here are a few good ways to get help from others in assessing teacher effectiveness. (transparency 4p) Why not find out from your students how effective you are as a teacher? Plan an informal discussion with your students as a follow-up to a lesson. An example of some questions you might ask are, "What did you enjoy today? Did you understand the lesson? How could I have helped you understand it more clearly?" Pre-plan your questions to get some pertinent feedback on specific things you need to know about your teaching. Written methods can also help you in evaluating your teaching. Every once in awhile write up a simple questionnaire related to your teaching and have your students answer it immediately following a lesson.

Ask your principal or another teacher to sit in on a class session and give you some helpful feedback. Maybe you can make an agreement with another teacher and evaluate each other. Plan in

advance quetions related to your teaching for them to answer, but allow them to give any input that might be helpful. Be open to their suggestions. Avoid being defensive. Self-evaluations can be very helpful. Without them growth is very slow. Learn to use a variety of assessment techniques, but above all, learn to adjust your teaching based upon what you learn from your evaluations.

10. Classroom Applications

Pass out handout sheet 4q. Assign appropriate classroom applications to be completed before the next workshop.

A CLASSROOM ATMOSPHERE THAT STIMULATES THINKING

a. Model a variety of in-depth thinking skills.

b. Involve all students and demonstrate that you value their answers.

c. Tolerate some complexity and disorder.

d. Use mistakes as ways to help your students improve.

e. Build a climate of respect and acceptance; let students share, develop, and learn from each other.

f. Encourage and use activities that require multi-level thinking.

g. Adapt to individual interests and ideas whenever possible.

Classroom Atomosphere to Stimulate THINKING

- Model thinking behaviors.
- Involve <u>all</u> students.
- Tolerate some ambiguity & disorder.
- Build on mistakes to help children improve.
- Build respect & acceptance.
- Use multi-level thinking.
- Adapt to individual interests & needs.

Task Cards For Activity 4

Pattern 4c

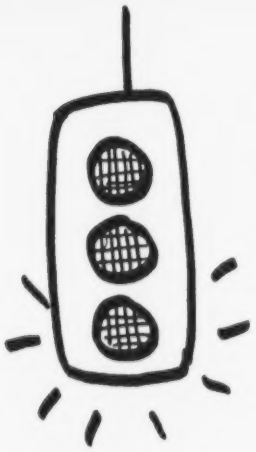
Cut these tasks apart and give to three participants in each group.

Task 1 - Make a mistake in answering the teacher's questions to challenge the teacher to use your mistake and build on it to help you improve.

Task 2 - Set up a situation that challenges the teacher to demonstrate respect and acceptance of your ideas.

Task 3 - Project a strong interest in a particular area to see if any of the teachers will be flexible enough to incorporate your interest.

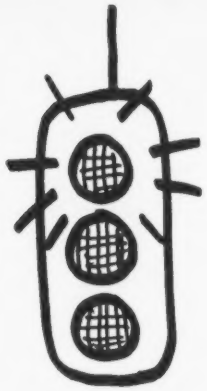
(Give out each of these tasks to different members in each group.)



GOOD QUESTIONS

Characteristics of good questions:

- Clear
- Brief
- Purposeful
- Natural
- Thought-provoking



POOR QUESTIONS

Unproductive questions

Yes - No

"Tugging"

Guessing

Leading

GUIDES TO GOOD QUESTIONS

- Distribute questions widely.
- Phrase questions to entire class.
- State questions once.
- Avoid repeating children's responses.
- Build on responses to extend thinking.
- Base decisions on responses.
- Judge your questioning
- Plan questions in advance.

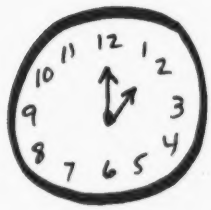
Hilda Taba's

QUESTIONING STRATEGY

Generalizations

Opening Questions

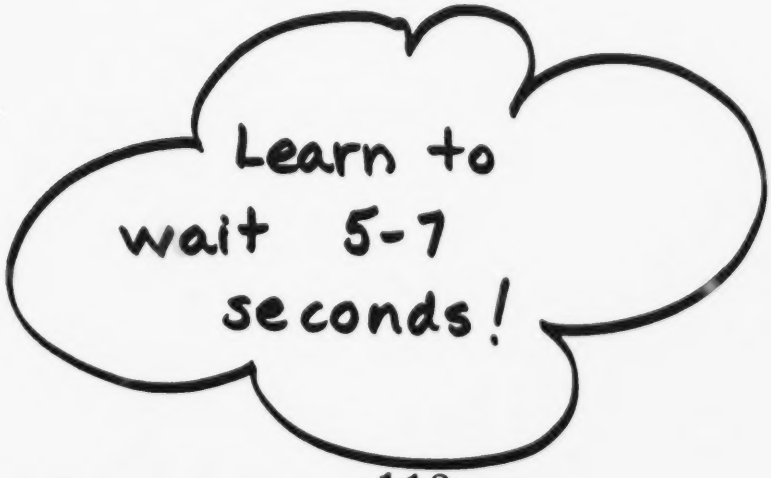
Mary Budd Rowe's WAIT TIME



Increase time after asking question.

Increased wait time results in:

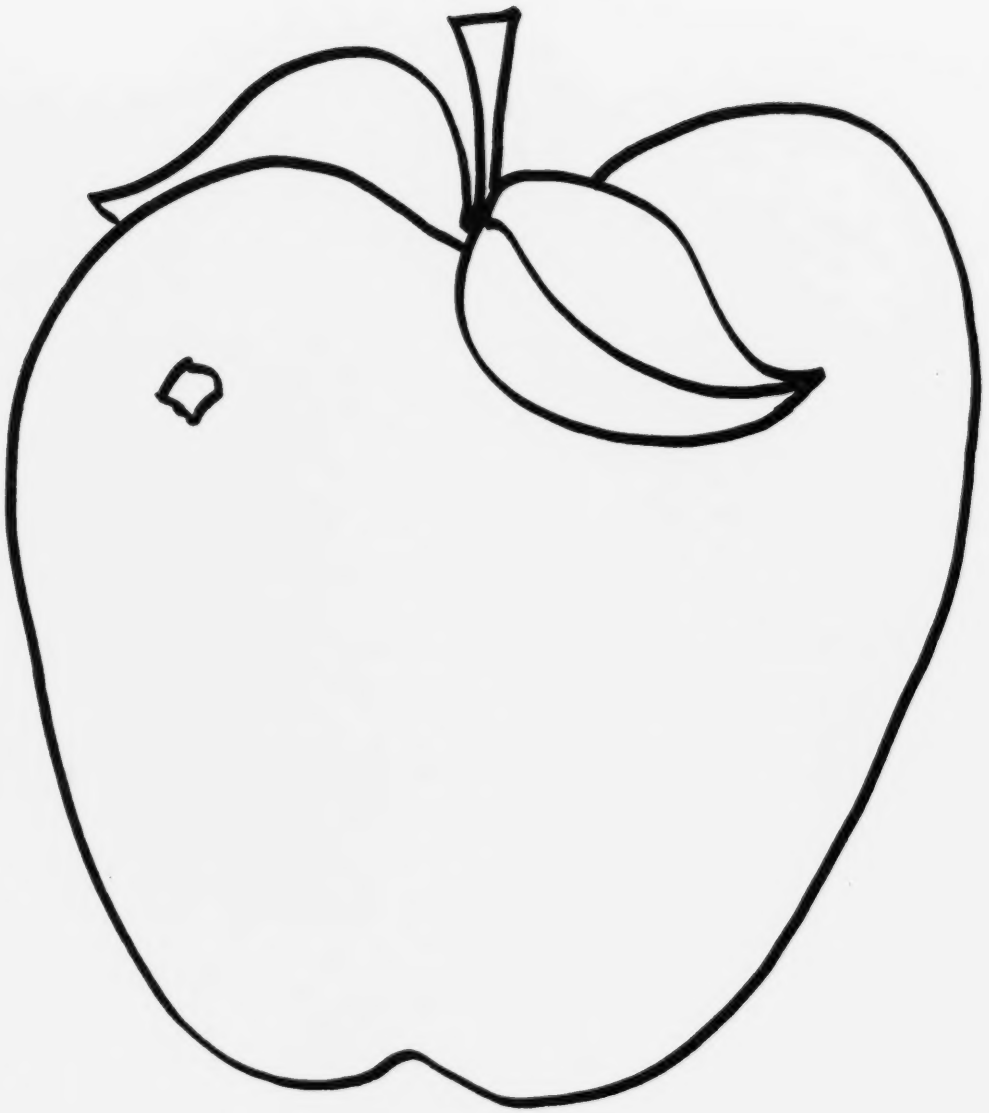
- More responses
- Longer responses
- More student-initiated responses
- Higher quality answers



4h

Natural
Purposeful
Clear
Include all students - Phrased to entire class
Well-planned ahead
Taba -- open, lift, generalize
GOOD Questions
Wait time
thought-provoking
Judge effectiveness from student responses
Built on student responses
Leading
yes-no
Poor Questions
Repeat student responses
Guessing

4i



Apple Pattern

Duplicate one apple pattern for each group of eight to ten participants.

EVALUATION

Evaluation helps us know:

- where we are
- what we have accomplished
- what we should do next

Kinds of evaluation

- student progress
- teacher effectiveness

4k

Efficient

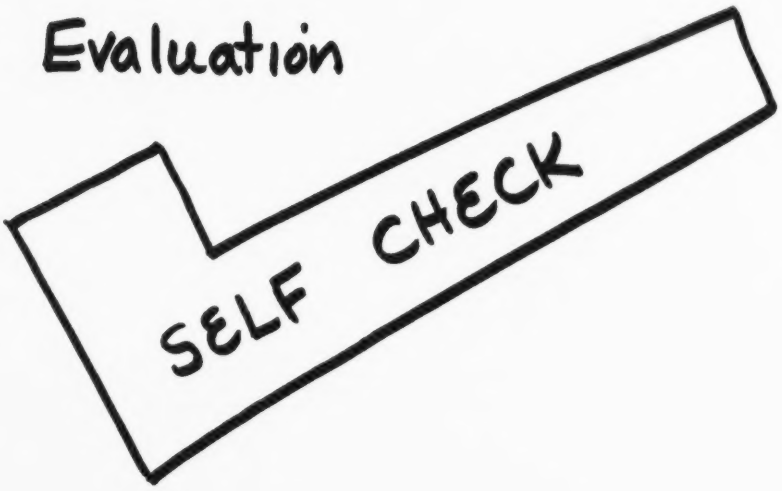
EVALUATION

Techniques

- Suggestions
  - Answer strips
  - Signaling
  - Partner checks
- Purpose -- to find out whether students are ready to move on or not
- Can be used to evaluate even complicated thinking
- Organize records
- Use for planning

4e

Teacher Evaluation



Did you accomplish objective?

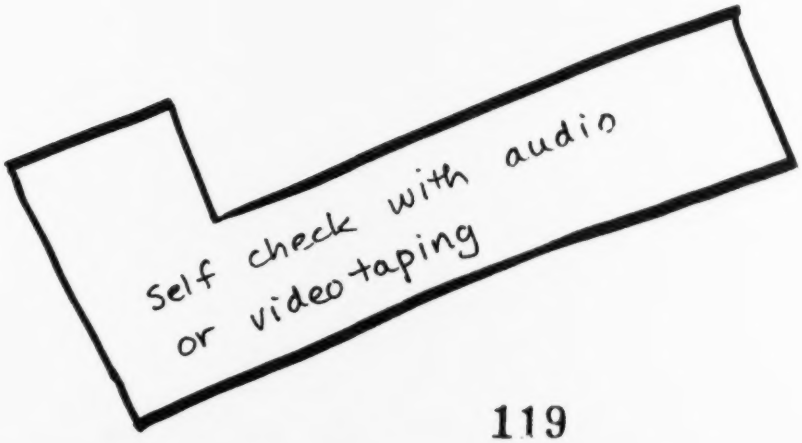
For problem solving:

- ✔ Did I explain adequately?
- ✔ Did I give ample opportunities for practice?
- ✔ Did I provide adequate feedback?
- ✔ Did I help students evaluate their progress?

- Teacher Evaluation

What kinds of questions do I ask?

- ✔ Did I use a variety of levels?
- ✔ Which levels did I use?
- ✔ Did I model thinking techniques?
- ✔ Which levels did I model?



4m

- Self-checking Teacher

- Go over tests
- See which questions children missed most
- Think back over instruction
- Plan ways to adjust and make content clearer

- OTHERS CAN HELP IN

EVALUATION

- Informal discussion with students
- Student questionnaires
- Principal
- Fellow teachers

4p

CLASSROOM APPLICATION-QUESTIONING AND EVALUATION STRATEGIES

In this workshop you have learned about setting a classroom atmosphere conducive to thinking, some general and specific guides for asking questions, ways to evaluate your students' skills at various levels of thinking, and techniques for assessing your effectiveness at teaching these skills. Now is the time to practice what you learned in your own classroom. Your leader will guide you in selecting several of the following tasks for practice with your class.

1. Take the first module of this workshop, "Creating a Classroom Atmosphere to Encourage Children's Thinking." (handout 4a) Make a brief list of specific things you can do in your class to establish that climate. Now work everyday for one week consciously trying to incorporate each of the seven ideas. At the end of each day briefly record the specific ways you incorporate each idea. At the end of the week you should see a pattern in your notes. You probably used some of the seven ideas more rapidly than others. From your notes pinpoint your weakness and your strengths. Share your findings in the next workshop.

2. Plan three specific changes to make in your classroom to improve the classroom atmosphere for students' thinking. Establish these changes. Record the difference in your students' responses as a result of these changes.

3. Make a brief checklist of ideas you would like to include to improve your questioning techniques. Be sure your list is simple with only the key words in each idea so you can check it quickly. After making your checklist, record yourself teaching a lesson on video tape or audiotape. Listen to your teaching tape and see how many ideas from your checklist you included as you taught.

4. Do you include all of your students in your questions or just those you know have the answers? Audiotape your lesson to find out which students you call on the most and which ones you leave out. Plan strategies to distribute your questions more widely. Write up your results.

5. Plan a lesson using Hilda Taba's questioning strategy. Plan in your opening questions, lifting questions and questions for generalizations. Share your results including student responses and your success and failure in the next workshop. Add your idea to your "Think Tank".

6. Practice Mary Budd Rowe's questioning strategy on four successive days. Determine if the number of student responses increases as a result of your lengthened wait time between questions and responses. Does the quality of student answers seem to improve by the fourth day period? Share your findings in the next workshop.

7. Plan and carry out a new form of student evaluation that you have not used before. It may be signaling, answer packets, partner checks, or a brand new combination. (Relate your assessment to your students' thinking skills.) Write up your results.

8. Make up a checklist to determine the level of thinking you elicit from your students, the frequency of each level, and the levels you demonstrate. Evaluate yourself by marking your checklist for at least two weeks. Be prepared to share the results of your self-evaluation.

9. Invite another teacher or your principal to evaluate your teaching of a lesson where you focus on asking questions. Give your evaluator a list of things to look for. Make a conscious effort to be open to their suggestions for improvement. Avoid being defensive. Plan specific ways to adjust your teaching to improve your weaknesses. Tell your evaluator your plans. Report your results at the next workshop.

WORKSHOP 5

USING THINKING SKILLS IN LANGUAGE ARTS

This workshop focuses on applying various thinking skills in the area of language arts. The leader will present examples of language arts activities and show how they can be used to encourage a variety of thinking skills. Participants will then work through other language arts activities and find ways to elicit various thinking skills with those examples. They will share their ideas with others. Then participants will plan strategies for encouraging their students to use the different thinking skills in language arts.

Workshop Leader Behaviors

The workshop leader will conduct the following activities:

1. Lead a sharing time of results of participants' experiences related to various thinking skills in improving questioning and evaluation strategies.

2. Present and demonstrate two language arts examples and discuss several possibilities for the use of thinking skills in the activities.

3. Organize participants to work together to plan thinking skills for other language arts activities.

4. Make classroom application assignments and allow participants to start work on it.

Workshop Preparation

Bring the book, Mr. Gumpy's Outing by Burningham to the workshop.

Prepare handouts 5a, 5b, and 5c.

Study the workshop overview and contents, adding examples of your own.

Participant Responsibilities

Inservice workshop participants will

1. Receive information on several activities and ways to stimulate children's thinking language arts.

2. Generate ideas for thinking activities for children as they study language arts.

3. Plan and carry out thinking activities in language arts with their own students.

Workshop Content and Activities

1. Sharing Results of Assignments Related to Creating an Atmosphere Conducive to Thinking and Evaluating

Lead a sharing session in which participants tell about their assignments on classroom atmosphere and evaluating children's thinking. Divide participants into groups of four for sharing. Let each participant share at least one assignment that they carried out in class and the responses of the students. Encourage them to share their successes and failures. Ask each group to select one especially pertinent example to share with all of the participants. After about fifteen minutes of small group sharing, lead a ten minute session where each group presents their selected novel applications.

2. Examples of Language Arts Activities to Promote Thinking

(Distribute handout 5a. Have participants look at the activity entitled, Mr. Gumpy's Outing.) Now let's see how we can use this activity to encourage every type of thinking we have studied. As the teacher asks the children if they have been on a boat ride before, he asks a convergent question because the answer is either yes or no. As the children tell about their different boat rides and as they imagine a boat ride, they are involved in divergent thinking which is the synthesis level in Bloom's Taxonomy. This category is divergent because there are many possible answers. When they show with their hands the size of the boat and the roughness or smoothness of the water, the children are using comprehension skills and translating information to another form. Children use divergent thinking skills again as they tell their partners about their imaginary boat ride. After the story the teacher asks, "How was Mr. Gumpy's ride like or different from yours?" This question encourages interpretation, which is part of comprehension. This is the interpretation level because the children are comparing. When the teacher asks, "Who got in the boat first, second, etc.," he is asking a concept question related to ordinal numbers. This question is a convergent question because there is one right answer. When the children tell whether or not the story could really happen and why or why not, they are using the evaluation level of Bloom's Taxonomy because they set a criteria for what is real or fantasy and then they judge the story by their criteria.

Now let's look back to the questions before and after the first story time and analyze them in relation to Hilda Taba's questioning strategy. "How many of you have ever been on a boat ride?" is an opening question. It is easy and all the children can respond. The lifting questions come after the story as the children compare their imaginary ride with Mr. Gumpy's ride and as they recall who got in Mr. Gumpy's boat first, second, and third. Lifting questions demand a higher level of thinking than opening questions. The children generalize as they decide

whether or not the story could be true and why. Remember generalization questions encourage children to consider the data and establish a rationale for their opinion.

As children make clay animals, they translate from one form to another. This type thinking is at the comprehension level. They must solve the problem of how big to make the boat so it will hold all of the animals. Then they make decisions about how to color the water and how to make representation of trees and bushes along the bank. In cutting magazine pictures of foods for the tea party, they are using divergent thinking and decision making. Divergent thinking is also used as children dictate a story about what Mr. Gumpy and his friends did the next day and as the children take imaginary trips in the boat on the playground. The children use problem solving as they make clay boats that float. They analyze as they estimate how many paper clips each boat will hold before it sinks and as they explain why the boat sank.

The next day the teacher asks the children what the story was about. When the children have to consolidate the story to tell the theme in a few sentences, they are analyzing. The decision whether or not Mr. Gumpy was wise to put all of those animals in the boat and why they think so is an evaluation question. When children suggest other vocabulary words for the story words "squabble, tease, muck about," and "bleat" they are involved in concept development and divergent thinking. When they tell the same story but make other words Mr. Gumpy could say to the animals they are thinking divergently. Can you suggest a place in this activity to apply Mary Budd Rowe's wait time theory?

(Give participants a few minutes to make suggestions. Encourage participants to suggest other ways to use these activities to draw different levels of thinking skills from children.)

Will you look at the next example used in a second grade classroom? Let's see how the teacher used this self concept writing activity to encourage different levels of thinking. (Allow participants a few minutes to become familiar with the unit, "Nobody Like Me.")

Notice as the children discuss their photographs and answer questions such as "What are you doing? Who are you with?", they are working on the convergent level because there is a correct answer depending on the photos. As children discuss their pictures with one another, they might move into the comprehension level with interpretation if they discuss relationships. They might use extrapolation as they move beyond the information in the picture and imply the unknown from the known. As children compare pictures and actual body features, they are involved in another type of comprehension interpretation. A discussion of their "sensory favorites," what they enjoy hearing, seeing and so on, is divergent in nature because there are many possible answers. The task of writing the booklet could involve many thinking skills: decision making, translation (part of comprehension) as they change information to another form to another,

and application as they solve problems and apply the information that they have assimilated to their booklets. The children use analysis as they break down the information about themselves and again as they pull the information together into a booklet; and the synthesis level or divergent thinking because there are many possible aspects to include in their books. When the children set up class publication rules to use to judge their booklets, they are working on the evaluation level. They use decision making in selecting the rules. They apply, application level, the rules of their writings. They are also using the concepts they have learned about punctuation, capitalization, and spelling. As the teacher evaluates the booklets, she asks, "What makes that sentence unclear? How could you make it say what you really mean?" The children must analyze to answer these questions because they use causal relationships and they must form a conclusion. The children must decorate the cover of their books with a symbol that represents them and select an appropriate title. These two tasks again call for decision making, problem solving, and analysis as they pull information together and state it succinctly in a symbol and again in the title.

The teacher asked an opening question when she asked, "What things did you learn about Jennifer from her book?" She moved to a lifting question with "What else do you know about her that she didn't tell in her book?" Then she asked two generalization questions: "What kind of person do you think Jennifer is? and "What other title could you suggest for her book - a title that would tell about Jennifer?" Did you notice that Mary Budd Rowe's wait time technique was used between the lifting question and the generalization questions? What other possibilities for thinking strategies did you find in the teaching project that I missed? (Give them time to respond.)

3. Planning Thinking Skills for Other Language Arts Activities

Have participants divide into groups of four. Give each participant handout 5b. Encourage each group to look through the handout to choose one of the activities, and to plan ways to incorporate each of the thinking skills into that activity. Allow the groups to add to their activities or alter them in any way necessary in order to apply the different thinking strategies. Give participants fifteen minutes to twenty minutes to work. Encourage the groups that finish early to work on a second activity. Circulate among the groups and help them with any problems. After the groups have finished working, have each group work with another group and share their results with each other for about five minutes. Let group members share especially interesting examples of various types of thinking with the entire group.

4. Classroom Applications

Give participants handout 5c, and ask them to carry out both activities on their assignment sheet before the next workshop.

USING THINKING SKILLS IN LANGUAGE ARTS

You will find two language arts activities in this handout. As you read the activities, you will notice that there are many possibilities for encouraging a variety of thinking skills. As the workshop leader discusses various thinking strategies and levels, make notes of examples of each strategy or level in the blank spaces. Add any other ideas you may have.

MR. GUMPY'S CUTING

The kindergarten teacher prepares to read Mr. Gumpy's Outing by John Burningham. To introduce the story, he asks, "How many of you have ever ridden in a boat before?" He allows time for a few children to tell about their boat rides. Then he encourages children to shut their eyes and pretend they are riding in a boat. They are to decide whether the boat is big or small and to show the boat size with their hands. They must picture whether the water is smooth or choppy, who is in the boat with them, how it feels, what they see along the way as they ride in the boat, and what they are doing. Afterwards the children open their eyes and share their mental pictures with a partner. Then the teacher encourages the children to listen carefully to the story to find out who goes with Mr. Gumpy on his boat ride and what happens. The teacher reads Mr. Gumpy's Outing. Following the story the teacher asks, "How was your imaginery boat ride like Mr. Gumpy's boat ride? How was it different? What animals went on Mr. Gumpy's outing? Who got in first, second, and so on? Could this story really have happened? Why? Why not?"

The follow-up projects to Mr. Gumpy's Outing will continue throughout the week. Some of the children make the animals from Mr. Gumpy's Outing out of clay. They then must decide how big they must make a boat to hold all of the animals. They place their "boat" on a large piece of butcher paper. They paint in water and construct images of trees and bushes

THINKING POSSIBILITIES
Convergent and Divergent Thinking

Bloom's levels of thinking:

- knowledge
- comprehension
- application
- analysis
- synthesis
- evaluation

Decision making:

Problem solving:

Concept development:

Taba's questioning strategy:

- opening
- lifting
- generalizing

Rowe's wait time:

Other ideas:

along the banks. Another group plans a tea party. They cut pictures out of magazines for the party and use the dishes from the housekeeping center. Another group dictates a story about what Mr. Gumpy and his friends did together the next day. A parent brings a row boat for the children to use on the playground and to take imaginary trips in. Some children make boats out of clay, put the boats in a tub of water, and fill them with paper clips. They estimate how many clips each boat will hold before it sinks. Then they discuss why the boat sank.

Another day after the children gather for story time, the teacher asks all of the children to tell what yesterday's story was about. He reads the story again. At the end of the story, he asks the children to decide if Mr. Gumpy was wise to take all of those animals in his boat. Why? Why not? He then presents new words from the story--words such as "squabble," "tease," "muck about," and "bleat." With each word,he asks children to suggest other words that mean the same thing. On a third day as he reads the story again, he asks the children to help him tell the story in a different way. As he mentions each animal in the book he says, "What else might Mr. Gumpy say to the animal?" The children suggest different possibilities. For instance when Mr. Gumpy tells the pig he can ride in the boat if he doesn't muck about, Kevin suggests that they change the story to say, "You can ride in the boat if you don't grunt and snort." The children continue each day with their projects.

NOBODY LIKE ME

The second grade teacher asks the children to bring a photo of themsleves from home. She takes pictures of those children who don't have a photograph so each child will have a picture to use. The teacher leads a discussion about the children's pictures as each child looks at his own picture. She asks questions such as

THINKING POSSIBILITIES
Convergent and Divergent Thinking

Bloom's levels of thinking:

knowledge

comprehension

application

"What are you doing in the picture? "Who are you with?" Then she asks each child to tell a partner about his picture. Each child then compares his own picture with his partner's picture telling how they are alike or different. The children continue by looking at their partners, instead of the pictures, telling similarities and differences.

The next day the teacher opens a discussion by saying, "There is nobody in the world like me. There is nobody exactly like you. Everybody has two eyes, hands and feet, but still each of us is different. Some people like to eat pizzas; others prefer hamburgers. What do you like to eat best of all? Some people love to hear the ocean roar; others would rather hear rock music. What do you enjoy hearing?" The teacher goes through each of the senses in the same way and asks children to express their zensory "favorites". After the children have had opportunities for discussion, the teacher encourages the children to write a booklet about themselves. On each page they are to describe their favorite things to eat, to smell, to hear, and so on. They write a sentence or a short paragraph and illustrate each sense. On another day the children work together to set up class rules to govern them in preparation for publishing their booklets. They formulate the following rules based on the concepts they have been learning in class.

Publication Rules

1. Be neat
2. Use the right kind of spaces between words.
3. Check your spelling.
4. Capitalize the first word in each sentence.
5. Capitalize the pronoun "I."
6. Use periods or question marks at the end of each sentence.

evaluation

analysis

synthesis

Decision making:

Problem solving:

Concept development:

Taba's questioning strategy:

opening

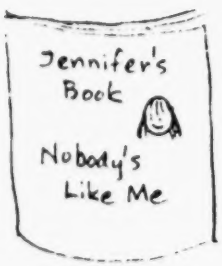
lifting

generalizing

Rowe's wait time:

Other ideas:

After the children have completed their booklets, they check their writing to make sure they have followed the publiction rules set up by the class members. Then they ask a friend to check their book before they take it to the teacher for evaluation. As the teacher evaluates each book in the "author's" presence, she checks for sentences that do not communicate clearly. As she reads that sentence aloud to the child, she comments that she doesn't understand what the author is trying to say. Then she follows with, "What makes this sentence unclear? How could you make it say what you really mean?" When the books have been evaluated, corrected, and completed, the children are ready to make a cover for their books. The teacher asks each child to decorate the cover of his or her book choosing some symbol that represents that child. Each child must think carefully and select a symbol that will give a clue as to who the author of the book is. The teacher also asks each child to make up an interesting title for his or her book. The photo may be incorporated into the title page, the contents of the book or on the cover of the book.



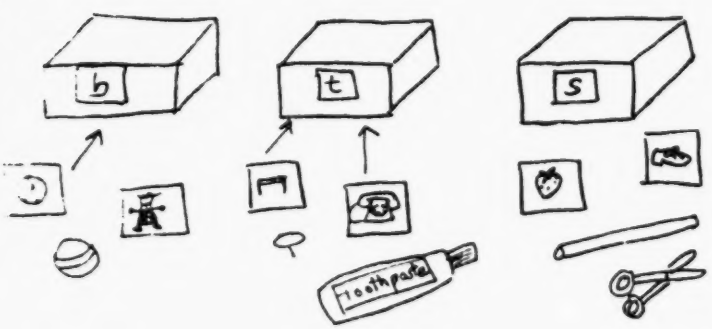
After the books are completed, the teacher takes time to read aloud the books of those children who want to share their writing with others. She asks questions such as, "What things did you learn about Jennifer from her book? What else do you know about her that she didn't tell you in her book?" She waits in silence in order to elicit more answers from the children. After several responses, she follows with two other questions: "From listening to Jennifer's book and from what you have already observed, what kind of person do you think Jennifer is? What other title might she have used?" The children's books are kept on the library shelf. Each book has a library card so children can check the books out overnight.

MORE POSSIBILITIES FOR USING THINKING SKILLS IN LANGUAGE ARTS

Now that you have seen how all of the thinking strategies can be used in language arts, it is time for you to apply your knowledge with a few more language arts activities. Work with your group and select one of the following activities. Find ways to apply each of the thinking strategies to that activity. You may extend the activity or alter it to help you create more thinking strategies.

SOUND BASKETS

The children are working with recognizing beginning sounds. The teacher has collected enough plastic strawberry baskets for each sound being studied. She has labeled each basket with a different letter. The children bring small objects or pictures of objects that begin with the letters represented in each basket. They name their objects and place them in the correct basket.



THINKING POSSIBILITIES
Convergent and Divergent Thinking

Bloom's levels of thinking:

- knowledge
- comprehension
- application
- analysis
- synthesis
- evaluation

Decision making:

Problem solving:

Concept development:

Taba's questioning strategy:

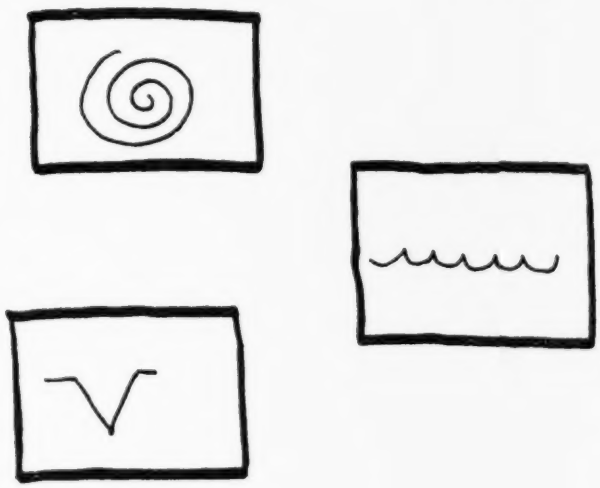
- opening
- lifting
- generalizing

Rowe's wait time:

Other ideas:

SCRIBBLES

The teacher has been talking to the children about the many ways we communicate with each other. She shows the children cards with different bright colored scribbles on them.



Then she asks the children to tell what the scribbles suggest to them. Each of the children uses markers to draw one more scribble for the other to "interpret."

On another day the children interpret the scribbles through movement as the teacher holds up different scribbles. The teacher suggests that movement is another way we communicate. Then she adds music as she holds up the different scribbles. The different moods and beats of the music affect the way the children move to the scribbles. The children discuss the different ways they moved and how the change in mood of the music made them want to move differently.

On another day each child selects a scribble for a beginning art theme. The child adds to the scribble using crayons, paper and glue, and makes a picture out of it a simple caption telling about the picture.

On the last day the children compile a list suggesting all of the ways we communicate.

THINKING POSSIBILITIES
Convergent and Divergent Thinking

Bloom's levels of thinking:

- knowledge
- comprehension
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- analysis
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Decision making:

Problem solving:

Concept development:

Taba's questioning strategy:

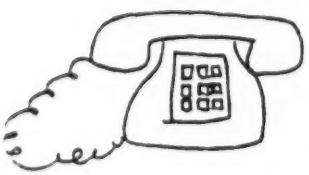
- opening
- lifting
- generalizing

Rowe's wait time:

Other ideas:

PHONE A FRIEND

The children have been working on memorizing their addresses and phone numbers. They have also studied some basic rules for using good manners on the phone. The teacher has cut out different magazine pictures. Each of the pictures clearly communicates a different situation and has brief directions written under the picture. For example, one picture portrays a house burning. The directions say, "Call the fire department. Tell them exactly where to come." Another picture shows a plate of cookies and two frosty soft drinks. The directions say, "Invite your friend over for snacks." The teacher brings two telephones to class. Working in pairs, the children select a picture, dial the appropriate number and talk over the phone carrying out the directions from the picture.



THINKING POSSIBILITIES
Convergent and Divergent Thinking

Bloom's levels of thinking:
- knowledge
- comprehension
- application
- analysis
- synthesis
- evaluation

Decision making:

Problem solving:

Concept development:

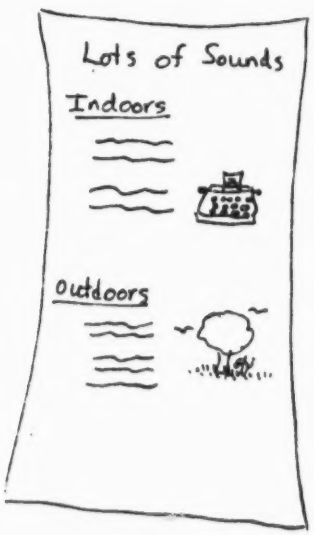
Taba's questioning strategy:
- opening
- lifting
- generalizing

Rowe's wait time:

Other ideas:

A LISTENING WALK

The children plan to go on a listening walk. The teacher divides the class into groups of three. They walk through the building and out-of-doors, noting all the sounds they can. When they return, the teacher gives each group computer printout paper and a marker and asks them to write their own experience chart related to the sounds they heard. Each child then draws a picture describing and illustrating one of the sounds.



THINKING POSSIBILITIES

Convergent and Divergent Thinking

Bloom's levels of thinking:

- knowledge
- comprehension
- application
- analysis
- synthesis
- evaluation

Decision making:

Problem solving:

Concept development:

Taba's questioning strategy:

- opening
- lifting
- generalizing

Rowe's wait time:

Other ideas:

DEVELOPING THINKING SKILLS IN LANGUAGE ARTS

Now it is time for you to practice applying the thinking strategies in language arts with your students in your classroom. These assignments are flexible enough for you to work these thinking strategies into the plan that you have already made for language arts.

1. Select four language arts activities that you plan to use in the near future. Choose one writing activity, one listening, one reading, and one speaking activity. Write some questioning strategies for each activity. Be sure to include at least four from the following strategies.

   Divergent thinking

   Bloom's levels of thinking (Use at least four different levels: knowledge, comprehension, application, analysis, synthesis, evaluation)

   Decision making

   Problem solving

   Concept development

   Taba's strategy (Use opening, lifting, generalization questions)

   As you plan your questions, designate which level of thinking you are eliciting. Put your questions on cards to add to your "Think Tank" box.

2. Apply Mary Budd Rowe's wait time technique in your language arts lessons at least twice during the next week. Make notes describing how you use this technique and the results.

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WORKSHOP 6

USING THINKING SKILLS IN MATHEMATICS

This workshop, like the previous one on language arts, features application of various thinking skills in a subject matter context. The leader will present examples of math activities and their potential for encouraging all types of thinking skills. Participants will then choose and work through other descriptions of math activities, finding examples of the various thinking skills. Participants will briefly share their thoughts with others, then plan to engage their students in various thinking taks in subsequent math lessons in their classrooms.

Workshop Leader Behaviors

The workshop leader will conduct the following activities:

1. Lead a sharing time of results of language arts and reading activities.

2. Present and demonstrate two math examples and discuss several possibilities for having children use thinking skills during the activities.

3. Organize participants to work on adding suggestions for stimulating children's thinking to more math activities.

4. Make an assignment to be carried out in the classroom and allow participants to start work on it.

Workshop Preparation

Prepare the following materials:

Handouts 6a, 6d, and 6e.
Transparency 6b and 6c.

Obtain an overhead projector.

Study the workshop overview and contents, adding pertinent examples of your own.

Participant Responsibilities

Inservice workshop participants will

1. Receive information on mathematics activities and ways to stimulate children's thinking in math.

2. Generate ideas for thinking activities for children as they study math.

3. Plan and carry out thinking activities in their classroom math lessons.

Workshop Content and Activities

1. Sharing of Results of Language Arts and Reading Workshop.

Lead a sharing session of language arts activities in which participants tell about language arts activities they carried out in their classrooms. Divide participants into groups of four. Have each describe one activity he or she carried out and all the thinking strategies that were involved. Ask each group to select an especially pertinent or novel example from those offered by group members. After about 15 minutes of small group sharing, lead a 10 minute large group session where each group presents its especially pertinent or novel applications.

2. Examples of Math Activities to Promote Children's Thinking.

(Distribute handout 6a. Have participants skim the graphing activity description.) Now let's see that the activity allows for virtually every type of thinking we have considered so far. Divergent thinking is fostered as children suggest poll topics and work in groups to select a topic. (transparency 6b). The children also think divergently as they suggest evaluation criteria. They will use convergent thinking as they make their graphs and in some of their interpretations of results. Deciding on what things to interpret, though, is divergent.

The students can use all of Bloom's levels in this activity. They work on the knowledge level as they count graph squares and remember to start filling in the graph squares at the bottom. The children are on the comprehension level as they tell about the graphs in their own words. Many opportunities for application of math and social skills are provided as children work together to gather information and make their graphs. They use analysis level thinking as they analyze the data by explaining the relationships of the heights of the graph columns. Children work on the synthesis level as they suggest and choose graph topics and categories. Finally the class has planned criteria for evaluating the finished graphs and can apply the criteria as presentations on the graphs are made.

The children use decision-making in their choices of graph topics, assignments of responsibilities within each group, and choices of what items to discuss with the class. (transparency 6c.) They are involved in all four steps of problem solving. Each group defines a problem to be worked out and plans to gather data. They carry out both the polling process and making the graphs. They can check themselves as they work together. Many concepts are developed and used as the children work. Some examples are using the ideas of appropriate categories; compiling, showing, and interpreting data; and comparing groups of data shown on a graph.

As the teacher presented the graphing project, she used Taba's questioning strategy. Her initial question, "What are topics

we could use for polls?" was open-ended and invited many responses. She lifted the level of the discussion as the children discussed workable graph topics and categories. The teacher helped the children generalize and review the steps in making graphs. These generalizations helped to guide their subsequent group work. As the teacher led the discussion, the children had varied and quick responses. The only place the teacher used Rowe's wait-time strategy was when she asked, "How will we know we have good graphing projects?" Here the children came up with ideas only after several seconds of wait-time.

(Now solicit other ideas for any of the thinking skills from the participants.)

Now let's look at some examples on the kindergarten level. Over a two-week period the teacher used many activities to teach the children about circles, squares, rectangles, and triangles. (Allow participants to skim the shape unit description.)

In the shape unit, there are many opportunities for convergent thinking. (transparency 6b.) The children must name the shapes correctly. Divergent thinking might occur as the children make their shape pictures, describe likenesses and differences in shapes, and look for shapes in the environment.

The children work on several of Bloom's levels. They memorize shape names. They work on the comprehension level as they interpret the shapes by drawing in sand or forming them with yarn. They apply their knowledge of shapes on the shape walk. The children analyze qualities of shapes as they describe likenesses and differences. They work on the synthesis level in making their own designs. No obvious uses of the evaluation level are in the unit. Could you suggest any evaluation level activities?

The children use decision making as they decide how to form various figures from yarn. (transparency 6c.) They solve problems as they work with the shape puzzles and the shape matching board. They define the problem as they ask themselves, which shape will match? As they plan to match the pieces, the children may manipulate pieces or look the pieces over carefully to see how they will match. They solve the problem as they actually match the pieces. The exercise is virtually self-checking. Concepts that are involved in the unit are the shapes themselves. Other concepts are curved and straight lines, square and not square corners, and numbers of sides in the figures.

As an introduction to the unit, the teacher held up a paper rectangle. He asked, "What can you see that's shaped like this?" as an opening question. The children looked around and found lots of examples. Pursuing Taba's strategy further, he asked lifting questions: "What do you notice about this shape?" "How are these shapes (a rectangle and triangle) alike? How are they different?" He helped the children generalize by asking, "What do we need to remember about a triangle?" "What have we

learned about a circle?" At various points in small and large group work, he used Rowe's wait-time strategy when the children initially hesitated to answer questions.

(Now ask for more suggestions of thinking skills for the shape unit example.)

3. More Examples of Math Activities to Promote Children's Thinking.

Ask participants to work in groups of four. Distribute handout 6k. Let each group choose one activity and add suggestions for the various thinking skills. Allow 15 to 20 minutes. Groups who finish early might tackle a second example. Circulate and clarify any problems. Have two groups come together to share results for about five minutes. Ask group members to share especially interesting examples of the various types of thinking for the entire group.

4. Classroom Applications.

Distribute handout 6e. Ask participants to complete both activities from the handout before the next workshop.

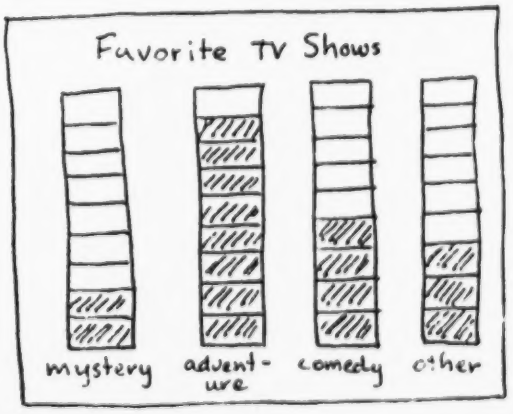
USING THINKING SKILLS IN MATHEMATICS

Descriptions of two math activities follow. Each activity has much potential for encouraging youngsters to think. Read through each example. As the workshop leader discusses various thinking strategies or levels, make notes of examples of each strategy or level in the blank spaces. Add your own ideas, too!

GRAPHING GROUPS

With teacher direction, second graders have made several bar graphs. To prepare for independent work on graphs, the teacher asks the children to suggest lots of possible poll topics. She helps the children to refine the topics and name some possible categories to choose from. She also helps them "weed out" some difficult topics. For instance, Andy suggested that they take a poll on favorite TV shows. As the children name some favorites, however, they see that 12 or 15 different shows are mentioned. The teacher helps the group to lessen the number of categories to just four: mystery, adventure, comedy, and "other." The teacher then has the group conclude with a list of the steps that will help them make good graphs.

Now the teacher makes the assignment: Work with a group of four. Plan and carry out a poll. Make a graph of the results using the graph forms with four columns. Present your graph to the class. Before they begin, the class sets up some standards for judging the effectiveness of the graphing projects.



THINKING POSSIBILITIES

Convergent and divergent thinking

Bloom's levels of thinking

- knowledge
- comprehension
- application
- analysis
- synthesis
- evaluation

Decision making

Problem solving

Concept development

Taba's questioning stragegy

- opening
- lifting
- generalizing

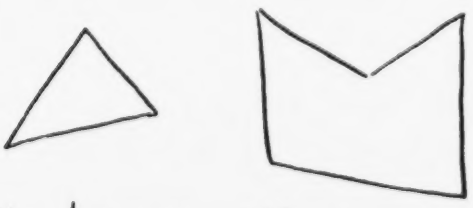
Rowe's wait time

Other ideas

A UNIT ON SHAPES: GEOMETRY

A kindergarten teacher wants his children to be able to match, describe, form, and name four geometric shapes: rectangles, squares, circles, and triangles. He involves the children in the following activities over a two-week period:

- Fit puzzle pieces into form boards.
- Match paper shapes onto a poster board with outlines.
- Form shape outlines with playdough.
- Use pushpins and yarn to form shapes.
- Trace shapes in sand in a sandtray.
- Walk around large geometric shapes taped to the floor.
- Gather little paper shapes in a shape hunt (like an Easter egg hunt). Sort and name the shapes they have found.
- Play "Shape Show Me." Each child has several shapes. The teacher asks "Show me all your circles," Show me a blue square," or "Tell me the name of this shape."
- Go on a shape walk around the building to find, identify, and describe various shapes.
- Draw shapes from a "mystery box." Describe and name the shapes.
- Make designs of precut shapes.
- Choose two shapes. Tell how they are alike and different.



"Alike because sides are straight."
"Different number of sides."

THINKING POSSIBILITIES

Convergent and divergent thinking

Bloom's levels of thinking
- knowledge
- comprehension
- application
- analysis
- synthesis
- evaluation

Decision making

Problem solving

Concept development

Taba's questioning strategy
- opening
- lifting
- generalizing

Rowe's wait time

Other ideas

Some Thinking Skills

- Convergent & divergent
- Bloom's levels
  - knowledge
  - comprehension
  - application
  - analysis
  - synthesis
  - evaluation

More thinking Skills

- Decision making
- Problem solving
- Concept development
- Taba's strategy
  - opening
  - lifting
  - generalizing
- Rowe's wait time

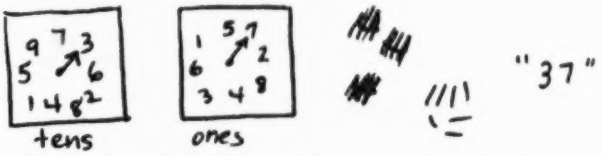
MORE POSSIBILITIES

USING THINKING SKILLS IN MATHEMATICS

Now it's your turn to suggest possibilities for using all types of thinking skills for some math examples. Work with your group to fill in all or most of the blanks for thinking possibilities. You may need to add extensions to each activity to create more thinking possibilities.

MATH SPINNERS:
NUMBER MEANING

Children use two spinners for tens and ones digits. They spin values and name numbers. They make bundles of straw counters to represent the numbers that they spin.



Next, the children spin two two-digit numbers. They tell which number is more and less or if the two numbers are equal.

First spin : 58
Second spin: 72

"58 is less than 72"

58 < 72

THINKING POSSIBILITIES
Convergent and Divergent Thinking

Bloom's levels of thinking:
- knowledge
- comprehension
- application
- analysis
- synthesis
- evaluation

Decision making:

Problem solving:

Concept development:

Taba's questioning strategy:
- opening
- lifting
- generalizing

Rowe's wait time:

Other ideas:

MAKING SALT DOUGH:
MEASURING

The teacher and assistant work with four different groups of students. Each group prepares salt dough using the recipe below.

SALT DOUGH

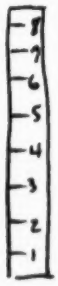
Mix together:
500 ml flour
250 ml salt

Add
125 ml hot water
60 ml oil

Mix well. Knead in food coloring. Store in a plastic bag.

The children each take a lump of dough and form it into shapes according to the teacher's directions. She uses instructions such as these: Make a snake about 8 centimeters long. Check your snake with your ruler. Make a pancake about 1 cm thick. Check the thickness with your ruler.

The children wrap the dough in plastic bags to save it for another day. They will later work in groups and make island models of the dough for a social studies project.



THINKING POSSIBILITIES
Convergent and Divergent Thinking

Bloom's levels of thinking:
knowledge

comprehension

application

analysis

synthesis

evaluation

Decision making:

Problem solving:

Concept development:

Taba's questioning strategy:
opening

lifting

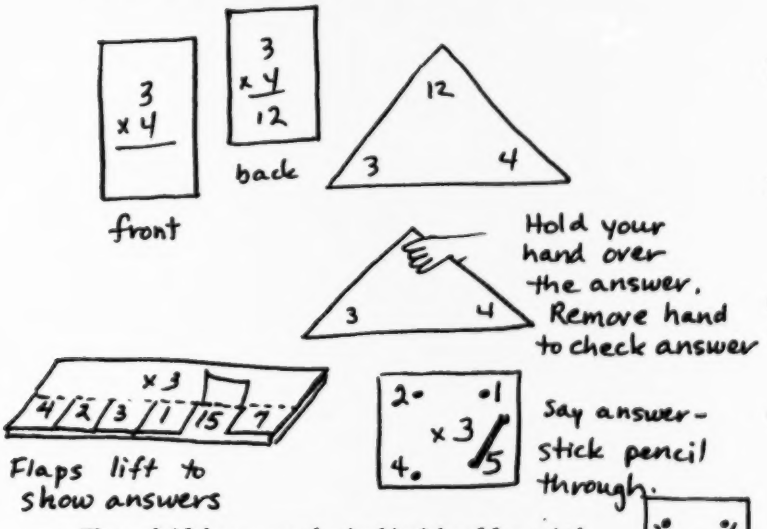
generalizing

Rowe's wait time:

Other ideas:

INDIVIDUALIZED FLASHCARDS: MEMORIZING BASIC FACTS

The children have worked with multiplication tables for several days. They have explored the meaning of multiplication as repeated addition and as skip counting. They have worked with rectangular arrays to represent problems such as 2x4, 1x6, and 3x3. Now it is time for them to memorize some facts. The teacher shows them several styles of cards as illustrated below. She asks the children to choose a style of card and make their own cards for at least 12 facts.



The children work individually with their flashcards, then let partners test them. As they can show that they have mastered facts, they put the cards into envelopes labeled "I know these facts." They have unmastered facts in envelopes marked "I need more practice on these facts."

THINKING POSSIBILITIES
Convergent and Divergent Thinking

Bloom's levels of thinking
- knowledge
- comprehension
- application
- synthesis
- evaluation

Decision making

Problem solving

Concept development

Taba's questioning strategy
- opening
- lifting
- generalizing

Rowe's wait time

Other ideas

MONEY BATTLE GAME:
MONEY

As the children study coins and their values, each child makes a set of cards. Ten cards have money values--5¢, 15¢, 23¢, 25¢, 40¢, 50¢, 55¢, 58¢, 70¢, 73¢. They also make ten cards with coin pictures on them to represent the following values--9¢, 12¢, 15¢, 25¢, 45¢, 62¢, 78¢, 80¢, 83¢, 92¢. To make the coin cards, they must decide on various combinations. For example, one child may show 9¢ as nine pennies; another might show 9¢ as a nickel and four pennies. For 80¢, one might use eight dimes while another shows two quarters, two dimes, and a nickel. The children next work with the coin cards with partners. They compare name and match values.

Now the children play the Money Battle Game. They work with partners and use two sets of cards shuffled together. Each takes half the cards. They simultaneously turn over a card and compare values. The child with the higher value takes both cards. If the values are equal, the cards are put aside. The player with the most cards wins.

70¢ "takes" the 55¢ card.

THINKING POSSIBILITIES
Convergent and Divergent Thinking

Bloom's level of thinking
- knowledge
- comprehension
- application
- analysis
- synthesis
- evaluation

Decision making

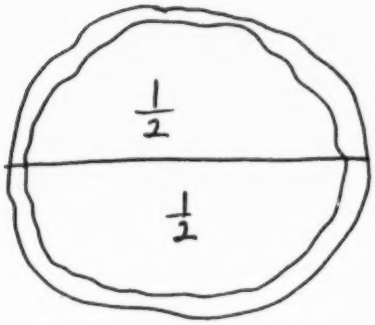
Problem solving

Concept development

Taba's questioning strategy
- opening
- lifting
- generalizing

Rowe's wait time

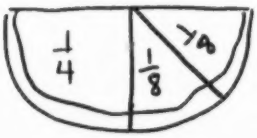
Other ideas



PIZZA SLICES:
FRACTIONS

Each child uses four pizza patterns (pattern attached) and colors the pizzas to create pictures of pizzas with ingredients they like. They cut out the pizzas. Now the children follow the teacher's instructions. They leave one pizza whole. They fold one pizza in half, then carefully cut it into two parts. They fold and cut the two remaining pizzas in fourths and eighths.

The children then use their pizza pieces to show various relationships. They find and show 1/8, 1/2, 2/4, and so on. They place pieces on top of each other to verify relationships such as 3/8 = 1/8 + 1/8 + 1/8, 1 = 4/4, 3/4 + 6/8. As they show various relationships, the teacher records appropriate number sentences on the chalkboard. As the children work with the pizzas as below, the teacher records 1/4 + 1/2 = 3/4.



$\frac{1}{2} = \frac{1}{4} + \frac{1}{8} + \frac{1}{8}$

THINKING POSSIBILITIES
Convergent and Divergent Thinking

Bloom's level of thinking
- knowledge
- comprehension
- application
- analysis
- synthesis
- evaluation

Decision making

Problem solving

Concept development

Taba's questioning strategy
- opening
- lifting
- generalizing

Rowe's wait time

Other ideas

SHOPPING SPREES: PROBLEM SOLVING

The children use newspaper and catalog ads to solve problems such as these:

- Find 2 different items for a total under $1.
- Buy a meat, bread, and drink for under $5.
- Buy any five items. Find your total. Make change from $100.00.

They cut out pictures and prices from the ads and write the problems on their papers. The teacher spot checks their answers or lets them check with a calculator.

The children report their work orally, then put their papers on a bulletin board for others to see.

ZEIGLER'S BOIL-BAKED-BLACK-RED-BBQ
LUNCHEON HAM
4 OZ. 98¢

TROPICANA CARTON
ORANGE JUICE
64 OZ. $1.39

FRESH BAKED
FRENCH BREAD
LOAF 69¢

98
69
139
total $2.96

THINKING POSSIBILITIES
Convergent and Divergent Thinking

Bloom's level of thinking
- knowledge
- comprehension
- application
- analysis
- synthesis
- evaluation

Decision making

Problem solving

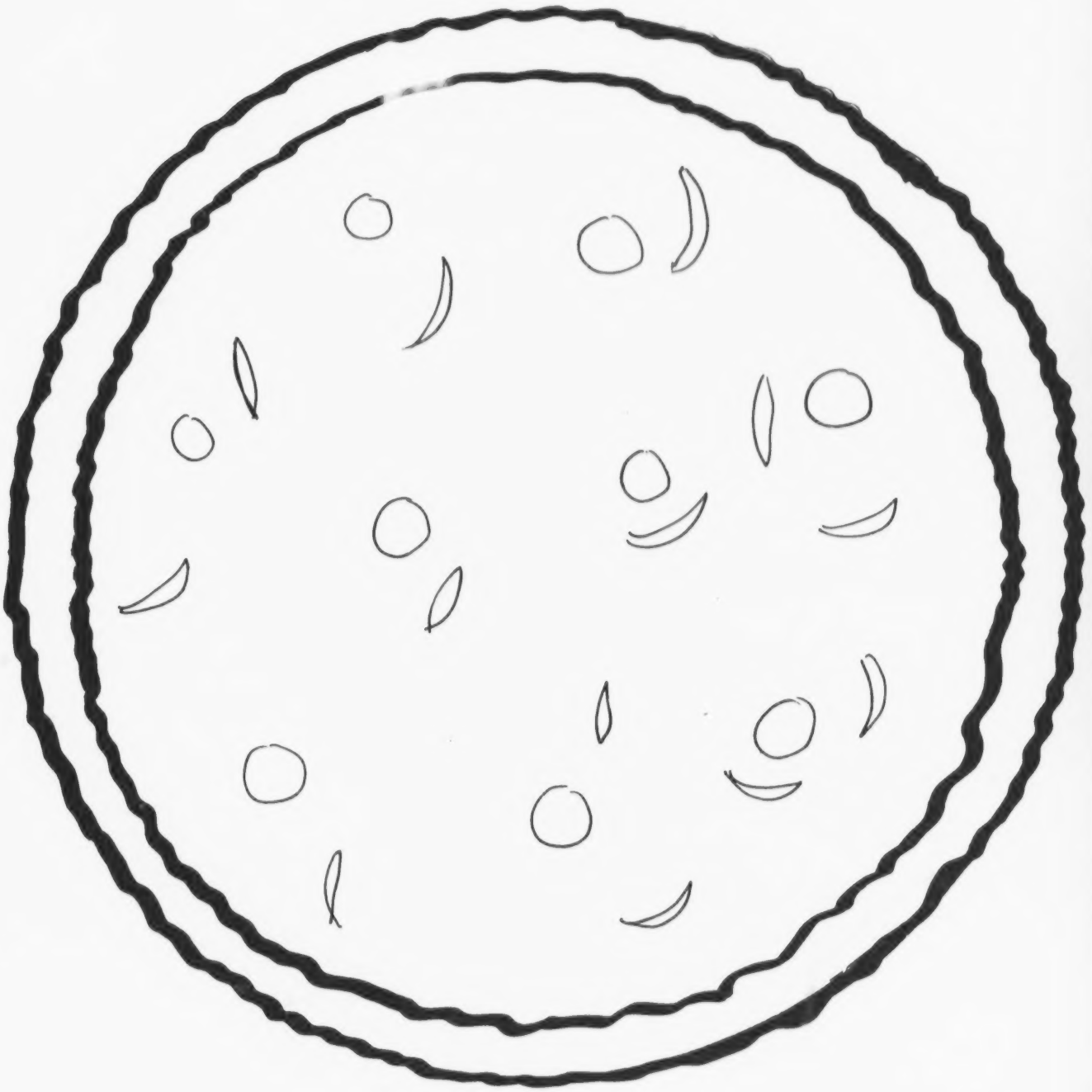
Concept development

Taba's questioning strategy
- opening
- lifting
- generalizing

Rowe's wait time

Other ideas

PIZZA SLICE PATTERN



DEVELOPING THINKING SKILLS IN MATH

Below are assignments to encourage you to develop your students' thinking skills in math. The assignments are open-ended and adaptable to almost anything you will be teaching in math.

1. Use at least two math topics you will be teaching in the near future. Plan some teaching activities that have potential for several types of questioning strategies. Write up a math activity or series of activities for each topic. Make notes of how you will use at least four of the following types of questioning and thinking strategies:

   Divergent Thinking

   Bloom's Levels of Thinking (Use at least four different levels: knowledge, comprehension, application, analysis, synthesis, evaluation)

   Decision Making

   Problem Solving

   Concept Development

   Taba's Strategy (Use opening, lifting, generalizing questions)

   Add cards to your "Think Tank" box for the two math topics you choose.

2. Apply Rowe's wait time idea in math learning at least twice in the next week. Make notes of when you used wait time and what the results were.

WORKSHOP 7

USING THINKING SKILLS IN SCIENCE AND SOCIAL STUDIES

This final workshop presents more applications of thinking skills in subject matter areas. For this session we concentrate on science and social studies and examine various thinking strategies within those subjects. After sharing the math activities they carried out in their classrooms, participants will work through science and social studies examples and see how they might engage students in various aspects of thinking. They will next plan to engage their students in a variety of thinking tasks in subsequent science and social studies lessons in their classrooms.

Workshop Leader Behaviors

The workshop leader will conduct the following activities:

1. Organize a sharing time for math activities previously completed in classrooms.

2. Present an example from science and from social studies in which children can engage in various thinking tasks.

3. Organize group work in which participants suggest possibilities for developing children's thinking skills in science and in social studies.

4. Assign classroom applications of thinking skills in science and social studies.

Workshop Preparation

Study the workshop notes and procedures.

Reproduce transparencies 7b and c.

Reproduce handouts 7a, 7d, and 7e.

Participant Responsibilities

Workshop participants will

1. Receive information on science and social studies activities that stimulate children's thinking skills.

2. Analyze science and social studies activities and find examples of different types of thinking skills.

3. Plan and carry out thinking activities in subsequent classroom lessons.

Workshop Content and Activities

1. Sharing Results from Math Activities in Which Children Used Various Thinking Skills.

   Lead a large group discussion of classroom applications. Ask volunteers to share ideas that were especially effective. You might start with convergent and divergent thinking. Let one or two participants describe a math activity they did in their classrooms and tell how convergent and divergent thinking were involved. Then ask another participant or two to tell how Bloom's levels were involved in a particular math activity. Proceed down the list of thinking skills, ending with examples of how Rowe's wait time strategy was used. This sharing session probably can proceed quickly because participants should be familiar with the meanings of the various thinking strategies.

2. Examples of Science and Social Studies Activities to Promote Children's Thinking.

   (Distribute handout 7a. Have participants skim the first activity description, Animal Habitats.) Could you pick out various kinds of thinking activities in the example? Here are some possible answers (transparency 7a). The children used convergent thinking to name the animals. Their naming of animals was recall--on the knowledge level. If no one in the group knew a particular animal name, the teacher told them, wrote the name on the board, and later asked them to recall the name. The children used divergent thinking when they described animals; the children were able to tell about many features of each animal. As the children compared animals' appearances, they worked on the comprehension level. When the children made their habitat boxes, they used application-level thinking and problem solving. They had to use available materials and portray a situation. They analyzed the needs of their chosen animals and decided how to provide an appropriate home. Because they created a unique product, the children work on the synthesis level. As the children discussed factors that made good animal homes, they set up criteria for Bloom's evaluation level. When they decided whether each group had made a suitable home, they used their criteria as the second part of working on the evaluation level. The children made decisions as they categorized the pictures of animal homes.

   Throughout their work, the children explored the concept (transparency 7c) that animals need appropriate homes. They explored many different examples of suitable homes.

   Mrs. Clayborn used Taba's questioning strategy in her teaching. She used an opening question, "Name some animal homes." Each child could contribute to the discussion. As the children looked at pictures of various animal homes, Mrs. Clayborn lifted the discussion by encouraging the children to look for and describe various features of the homes. The children generalized about

features of homes before they made their habitat boxes. Mrs. Clayborn found that the children were ready with answers on most of her questions. She used Rowe's idea of wait time only as the children generalized about factors that made good animal homes. (Encourage participants to give other examples of possibilities for using thinking skills in the animal homes activity.)

(Now have participants skim the second example, Winter Holidays in Other Lands, from handout 7a.) Ms. Kelly had the children think convergently (transparency 7b) on Bloom's knowledge level, as they recalled facts about holidays in other lands. She may have also asked some divergent thinking questions--ones with several answers--as the children described pictures. For example, "What do you see here?" or "What seems to be happening in this picture?" are divergent thinking questions.

Ms. Kelly's students used Bloom's comprehension level as they described holiday customs in their own words. They applied facts they had learned as they drew pictures of holidays in other lands. Because their pictures were creative new products, the children worked on the synthesis level. As they compared and contrasted pictures and holiday customs, the children analyzed. When they told why they preferred their favorite holidays for the graphing activity, the children worked on Bloom's evaluation level. What other uses of Bloom's levels are present?

In the Winter Holiday unit the children made several decisions (transparency 7c)--what books to read, what pictures to draw, and what their families might have in common with others around the world. The children encountered and solved problems in cooking and drawing activities. Their concepts of life in other lands and commonalities of families were strengthened by each activity in the unit.

Ms. Kelly used Taba's questioning sequence in the final activity. She asked for specific facts to be recalled as an opening portion. She lifted the level of the discussion by asking children to compare and contrast customs. Finally, the children generalized about family commonalities. When children were not ready with answers, Ms. Kelly employed Rowe's wait time strategy. What other examples of children's thinking skills were used in the unit?

3. More Examples of Thinking Skills in Science and Social Studies.

Organize participants in groups of four according to grade level. Distribute handout 7d. Ask each group of participants to select two activities and work through them, noting as many possibilities for encouraging thinking skills as they can. After 20 minutes or so, have participants share their ideas.

4. Assigning Classroom Applications.

(Distribute handout 7e and clarify the participants' assignment.)

USING THINKING SKILLS IN SCIENCE AND SOCIAL STUDIES

SCIENCE: ANIMAL HABITATS

As part of her class's study of animals, Mrs. Clayborn focused on animal homes and habitats. She showed the class lots of animal pictures. The children named the animals that were shown in the pictures. They described and compared the animals and talked about animals that blend into the background; they discussed the word "camouflage." The children next named various animal homes. They examined pictures of various animal homes. They sorted the pictures in three categories: where the animal makes its home (nests, cocoons, burrows), where the animal uses a home already there (caves, ponds, trees), and where people provide a home for the animal (stable, pen, hen house). They discussed factors that make good homes for animals (sturdiness, blending into surroundings, safe from enemies).

Next, the children worked in groups. Each group used a shoebox, dirt, sand, and uprooted weeds. They planned and created a little habitat in which they showed an animal home and added a clay model of the animal. The groups reported to the class, explaining their models. The class decided if each model of an animal home was suitable.

THINKING POSSIBILITIES
Convergent and Divergent Thinking

Bloom's levels of thinking
- knowledge
- comprehension
- application
- synthesis
- evaluation

Decision making

Problem solving

Concept development

Taba's questioning strategy
- opening
- lifting
- generalizing

Rowe's wait time

Other ideas

SOCIAL STUDIES:
WINTER HOLIDAYS IN OTHER LANDS

As part of Ms. Kelly's study of families, she presents a unit on winter holidays. She presents ways different people celebrate during the winter. She also brings out the idea that families in other lands are basically the same: they celebrate together according to particular customs, play together indoors and outdoors, and often eat foods associated with their holidays.

Some specific things Ms. Kelly's children did included:

- Described pictures that showed a winter carnival in Canada, a Hannukah celebration in Israel, the burning of a Yule log in Germany, and a black Mississippi family celebrating Christmas.

- Listened to stories, read books, and individually examined pictures of holidays in the four countries.
- Prepared hot chocolate, potato latkes (pancakes), yule log cake, and sweet potato pie.
- Drew pictures showing a celebration in another land and their own winter celebration; explained their pictures to their classmates.
- Told about their own winter holiday customs individually.
- Made a graph of their own favorite holidays and told why they chose the holidays they did.
- Recalled facts about holidays in other lands; compared customs between pairs of countries (for example, what were some things families do outdoors in Canada that we don't do in Mississippi?); decided what families had in common as they celebrated holidays.

THINKING POSSIBILITIES
Convergent and Divergent Thinking

Bloom's levels of thinking
- knowledge
- comprehension
- application
- synthesis
- evaluation

Decision making

Problem solving

Concept development

Taba's questioning strategy
- opening
- lifting
- generalizing

Rowe's wait time

Other ideas

Ways to Encourage

THINKING SKILLS

- Convergent & divergent thinking
- Bloom's levels of thinking
  - knowledge
  - comprehension
  - application
  - analysis
  - synthesis
  - evaluation

More Ways to Encourage THINKING SKILLS

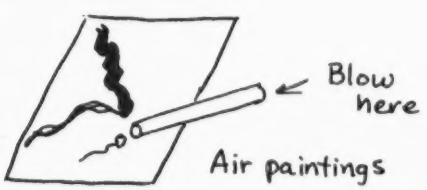
- Decision Making
- Problem Solving
- Concept Development
- Taba's Questioning Strategy
  - Opening
  - Lifting
  - Generalizing
- Rowe's Wait Time Strategy

MORE POSSIBILITIES FOR USING THINKING SKILLS IN SCIENCE AND SOCIAL STUDIES

Here are some more descriptions of science and social studies activities. Work with a group to examine the examples and write ideas for how several of the thinking skills could be utilized. Try to fill in most of the blanks. Add extensions to the activities to increase their potential for encouraging children to use various kinds of thinking skills.

SCIENCE: AIR IS REAL

Children discuss the fact that air moves things and give many examples. They blow drops of paint on paper by blowing through sections of straws, thus creating "air paintings." They wet sections of a counter top with water and with alcohol.



They fan the sections and compare the rate of evaporation. They squeeze a plastic bottle and feel the air come out. They hold the bottle under water and watch air bubbles form and rise as they squeeze the bottle. The children hang wet doll clothes out in the wind and inside the classroom where there is little breeze. They compare the rates of drying.

As a conclusion, the teacher leads the children to recall and explain all the things they have done with air. The class makes some conclusions about how we know that air is real.

THINKING POSSIBILITIES
Convergent and Divergent Thinking

Bloom's levels of thinking
- knowledge
- comprehension
- application
- synthesis
- evaluation

Decision making

Problem solving

Concept development

Taba's questioning strategy
- opening
- lifting
- generalizing

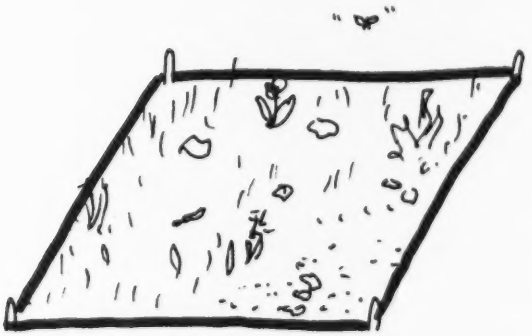
Rowe's wait time

Other ideas

SCIENCE:
WHAT'S ON THE GROUND?
WHAT'S IN THE GROUND?

Children work in groups. They use yarn and popsicle sticks and "stake off" one meter by one meter sections of earth in various locations. Each group carefully examines their one square meter section of earth and lists and categorizes all they find there. For example, one group categorizes things as "living" and "nonliving." Another group chooses "natural" and "made by people" as their categories.

The groups come together and the teacher leads a discussion and comparison of what they found in their square meters. The children try to explain why differences in their findings occurred. For instance, a group whose square meter was in a shady area found more grass and moss than a group whose square meter was in a dry, sunny, high-traffic area. The children attribute the difference to the lack of moisture and constant traffic in the latter area.



THINKING POSSIBILITIES
Convergent and Divergent Thinking

Bloom's levels of thinking
- knowledge
- comprehension
- application
- synthesis
- evaluation

Decision making

Problem solving

Concept development

Taba's questioning strategy
- opening
- lifting
- generalizing

Rowe's wait time

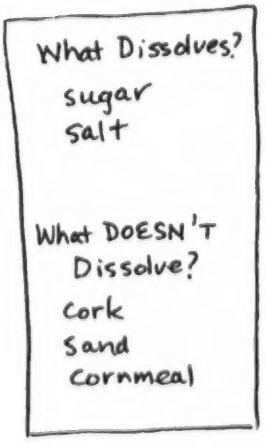
Other ideas

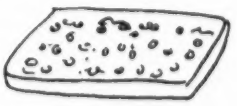
SCIENCE:
DISSOLVING AND EVAPORATING

As part of their study of the properties of water, a second grade class works with dissolving and evaporating. They predict which substances they think will dissolve in water. They test out their predictions and see whether sugar, sand, salt, bits of cork, or cornmeal dissolve when they are stirred into water. Once they see that sugar and salt dissolve, they test to see whether the amounts of sugar and salt that dissolve in hot water and cold water are the same or not. They record their results.

Next the children make strong solutions of sugar water and salt water by dissolving as much of each substance in water as they can. They pour half of each solution into a glass and into a flat styrofoam tray. They predict which will evaporate first or whether the solutions will evaporate at the same rate. After several days the water evaporates and crystals are left. The children examine and compare the crystals that form.

The teacher leads a review session where the children detail the many things they have learned.





crystals form more quickly in the tray than in the glass

THINKING POSSIBILITIES
Convergent and Divergent Thinking

Bloom's levels of thinking
- knowledge
- comprehension
- application
- synthesis
- evaluation

Decision making

Problem solving

Concept development

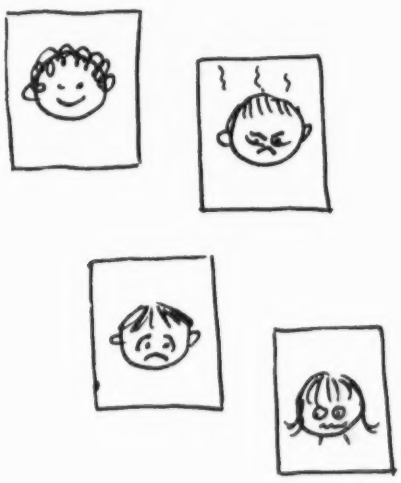
Taba's questioning strategy
- opening
- lifting
- generalizing

Rowe's wait time

Other ideas

SOCIAL STUDIES:
EMOTIONS

Kindergarteners talk about things that make them feel happy, angry, sad, and scared. They identify pictures that show various emotions. They role play emotional situations and ways to improve unhappy or frustrating situations. They listen to stories and identify and discuss various emotions inherent in the stories. Each child makes a booklet with pictures of emotions drawn and cut from magazines. Finally, the children dictate a list, "Our Happy Classroom," describing all the things that make them happy at school.



THINKING POSSIBILITIES
Convergent and Divergent Thinking

Bloom's levels of thinking
- knowledge
- comprehension
- application
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Decision making

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Concept development

Taba's questioning strategy
- opening
- lifting
- generalizing

Rowe's wait time

Other ideas

SOCIAL STUDIES:
FAMILIES

Second graders draw pictures of their family life. The next day they add pictures of family chores. On a third day they portray ways that family members help each other.

The children discuss interdependence within the family and talk about what various family members give and receive from each other. They tell how they might help within their families if someone was ill or if the family needed to make drastic budget cuts. They list many ways people in families show their love and give each other emotional support.

The teacher reads to the children several stories about families that face various kinds of problems. The children talk about the problems and discuss different ways to solve each problem. Each child creates a special "I Appreciate My Family" booklet in which the child lists specific things that he or she values in the family.

THINKING POSSIBILITIES
Convergent and Divergent Thinking

Bloom's levels of thinking
knowledge

comprehension

application

synthesis

evaluation

Decision making

Problem solving

Concept development

Taba's questioning strategy
opening

lifting

generalizing

Rowe's wait time

Other ideas

SOCIAL STUDIES: GOODS AND SERVICES

A second grade teacher introduces the terms goods and services. Goods are material objects; services are work done without producing material objects. The teacher asks the children to name lots of examples of goods and services while she lists them on the chalkboard.

The children split into groups of six. The teacher and aide circulate and help the children sort pictures of goods and services and explain why they categorized the pictures as they did. Each group then chooses a particularly interesting picture of a good and one they thought was especially interesting for a service. Each group reports on their interesting picture to the entire class.

To conclude their study of goods and services, the children draw pictures of goods and services. They suspend the pictures from coat hangers to make "Goods-Mobiles" and "Service-Mobiles." They hang the mobiles from the ceiling. Finally, the children take a short quiz identifying goods and services and drawing a picture of a good and a service they would like to use or receive.

THINKING POSSIBILITIES
Convergent and Divergent Thinking

Bloom's levels of thinking
- knowledge
- comprehension
- application
- synthesis
- evaluation

Decision making

Problem solving

Concept development

Taba's questioning strategy
- opening
- lifting
- generalizing

Rowe's waiting time

Other ideas

DEVELOPING THINKING SKILLS IN SCIENCE AND SOCIAL STUDIES

Here are some more assignments to help you encourage children to use various thinking skills as you work in science and social studies. The assignments should be applicable to any topic you are teaching in the near future.

1. Plan at least one science and one social studies activity to include many opportunities for young children to think. Include at least four of the following types of thinking:

   Divergent Thinking

   Bloom's Levels (Use at least four different levels--knowledge comprehension, application, analysis, synthesis, evaluation.)

   Decision Making

   Problem Solving

   Concept Development

   Taba's Strategy (Use opening, lifting, generalizing questions.)

   Write up your plans. File them in your "Think Tank" box after you have used them.

2. Apply Rowe's wait time idea as you teach science and social studies. Make notes of places where Rowe's ideas was particularly useful.